(Second Series) Vol. 25—No 1.

Western Australia

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA

Issued by Direction of

THE MINISTER FOR AGRICULTURE
Hon. G. B. WOOD

PUBLISHED QUARTERLY

All exchanges and correspondence should be addressed to
THE UNDER SECRETARY, DEPARTMENT OF AGRICULTURE
PERTH, WESTERN AUSTRALIA.

EDITOR — F. SAUNDERS

MARCH, 1948

By Authority: WILLIAM H. WYATT, Government Printer, Perth.
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JOURNAL
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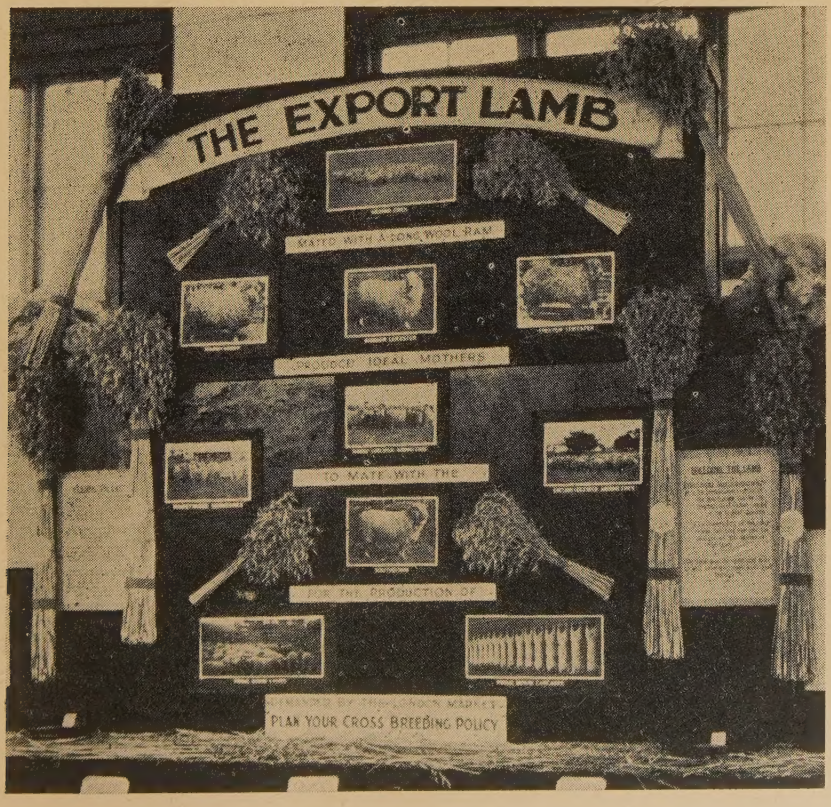
Vol. 25. (Second Series) MARCH, 1948 No. 1

ROYAL SHOW 1947

DISPLAY OF THE DEPARTMENT OF AGRICULTURE.

The 1947 Royal Show Exhibit was organised by Mr. G. R. W. Meadly, who prepared the following article based on information supplied by the various branches.

The exhibit at the 1947 Royal Show prepared by the various branches demonstrated the great diversity in agriculture in Western Australia, the variety of products and the problems of the man on the land. It also directed attention to the many aspects being investigated by the Department and the range of subjects concerning which advice is obtainable.



Naturally only a small proportion of the farming community was able to attend the show and examine the exhibits but a pictorial record has been prepared which, along with brief descriptions, will convey some impression of their nature.

A display devoted largely to stock husbandry in the wheat belt along with the production of cereal crops was prepared by the Wheat Branch. The exhibit covering stock husbandry was centred around the export lamb industry. By the use of photographs, the several stages in the production of prime export lambs were shown including the breeding of the crossbred ewe from the mating of long wool English rams with the Merino ewe, and the production of the prime carcase resulting from the mating of the Southdown ram with one or other types of the crossbred ewe. In order to produce prime lambs it is essential that the feeding of both the lamb and the ewe be efficient and nutritious.

Supplementing the lamb exhibit was a display illustrating, by medium of photographs, posters and actual pasture exhibits, the recommended pasture mixtures and fodder crops for wheatbelt conditions. It was also shown that in addition to improved pastures being necessary for maximum stock production, they are essential for the building up and maintenance of the soil fertility and play no small part in soil conservation. Legumes have an important place in improved pastures.

In addition to providing good pastures and fodder crops, it is also essential to conserve adequate fodder for the lean periods of the year. The main reasons for conservation and suitable types of fodder were set out in the appropriate placards.

The growing of barley, particularly for malting, is of considerable importance in some areas of the wheatbelt, and information was provided concerning varieties and requirements for good malting grades.

The production of pedigree seed wheat, oats and barley, is a major operation of the Wheat Branch and the system of pure line breeding of such seed was graphically illustrated, showing that the seed distributed to farmers is never more than a few years away from single plants, which ensures purity of the seed distributed.

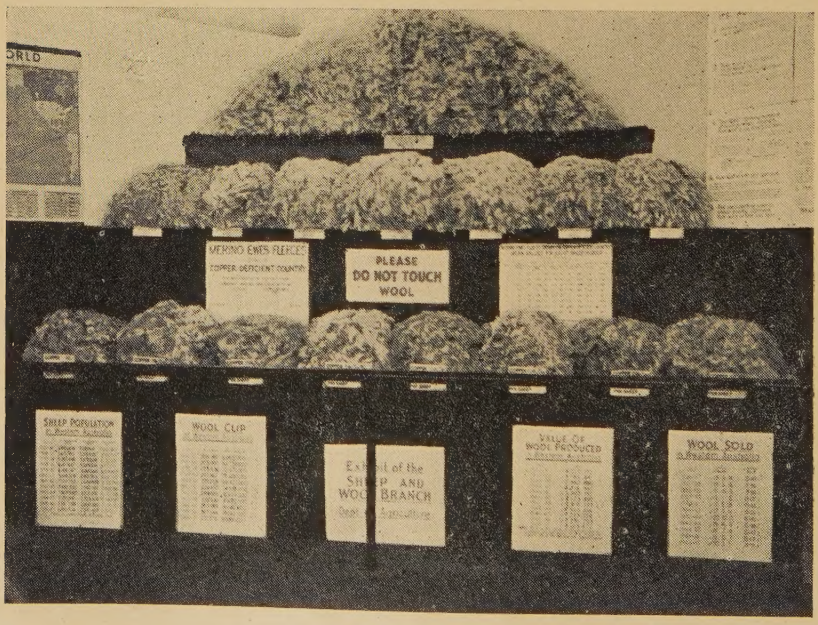
The desirability of farmers obtaining regular supplies of pedigree seed for planting stud plots on their own properties was stressed and bags of graded seed of the recommended varieties of wheat, oats and barley were displayed around the base of the stand. Interspersed between the placards and photographs were sheaves of the recommended varieties of cereals bearing cards describing their main characteristics. Small samples of some of the varieties of minor importance and newly produced or introduced varieties were also displayed.

Wheatbelt agriculture is primarily based on wheat growing and the recommended methods for, and times of carrying out, the various cultural operations were graphically illustrated by placards and the use of photographs showing modern implements in operation.

In order to acquaint farmers with the correct time for planting the different cereals in each district, seeding calendars for the three rainfall zones of the wheatbelt were displayed. These calendars illustrate the optimum seeding periods and the different maturities of the recommended varieties.

The exhibit prepared by the sheep and wool adviser included a display of Merino fleeces from a number of important wool districts, together with cards giving figures concerning sheep population and wool production and values during the past ten years.

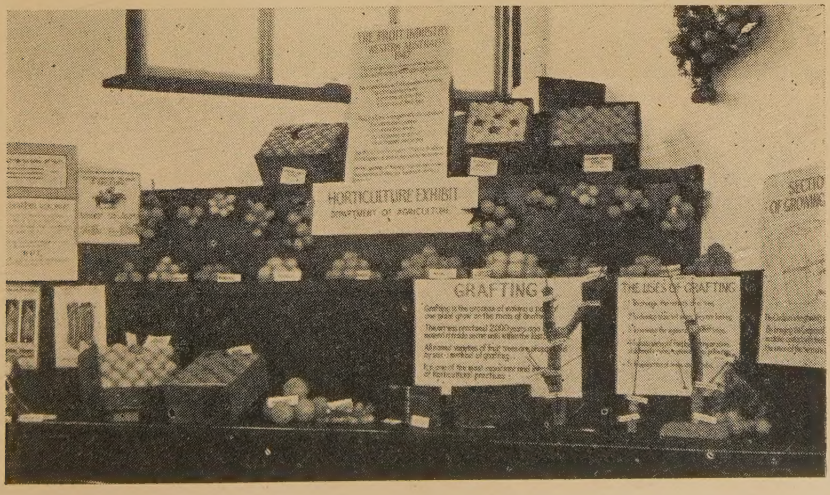
The remarkable responses to copper supplements ranging from 0-20 mg. per day were demonstrated by a series of eight Merino fleeces. Visual evidence was supported by information concerning improvement in both quality and yield following the usage of copper in a deficient area.



Maps and cards were utilised to show the wool producing, buying and consuming countries in the world together with sheep population, wool consumption per head of population, etc., for these countries. Stages in manufacture from raw wool to the finished fabric were depicted with stress on the valuable characteristics of pure wool for the manufacture of textile fabrics.

The display of the Dairy Branch dealt with both primary and secondary aspects of the industry. Various species of plants utilised for forage purposes were exhibited. Besides butter, ice-cream and condensed milk produced by local manufacturers, the display also included various by-products of milk and the manner in which they are employed for the manufacture of many commercial products.

The section of the exhibit shown above emphasises the importance of grade herd recording in improving production in herds throughout the State and illustrates the equipment used in the Babcock test which is employed for determining the percentage of butterfat in milk. The model pig depicted the ideal baconer while both desirable and undesirable types of carcases were shown on the wall cards.



The exhibit of the Horticultural Branch showed the various types of fruit of main commercial importance in Western Australia with the exception of tropical fruits. A collection of the different types and varieties of citrus and pome fruits was displayed, together with general statistics pertaining to the fruit industry.

The export of both apples and citrus being of particular importance at the present time, examples were shown of cases of these two fruits packed for the export trade.

In a section of the display set aside for instructional purposes, examples of various types of fruit tree grafts were shown. Explanatory posters were attached to this section giving technical and general details concerning the procedure.

The viticultural display was exhibited by the Western Australian Wine Makers' Association and consisted of a very attractively labelled and arranged display of all commercial types of wine.

Geographically Western Australia is well situated for the production of many kinds of high class fruit, including the grape. It possesses a huge expanse of country adjacent to the coast assured of the rainfall necessary to produce luxurious vine growth and associated high quality grapes.

The long sunny summers mature the grapes to practical perfection, thus originating high flavours and characters, combined with high specific gravity which are conducive to the production of quality wines. Wines from Western Australia are at least the equal of those from other States, a feature that has been demonstrated on more than one occasion in recent years, by winning championships and other awards.

The display included production figures for recent years showing that the 751,447 gallons produced in 1946-47 approximated the record for any one season.

The main feature of the Vegetable Branch exhibit was a sample of vegetables as packed for overseas export. Emphasis was given to this aspect because, with the rapidly expanding export trade, close attention must be given to quality and type of vegetables, suitable containers and correct marking and packing.

Charts illustrating the value of these markets were displayed, showing an increase in overseas export from £2,000 in 1938-39 to £348,000 in 1946-47.

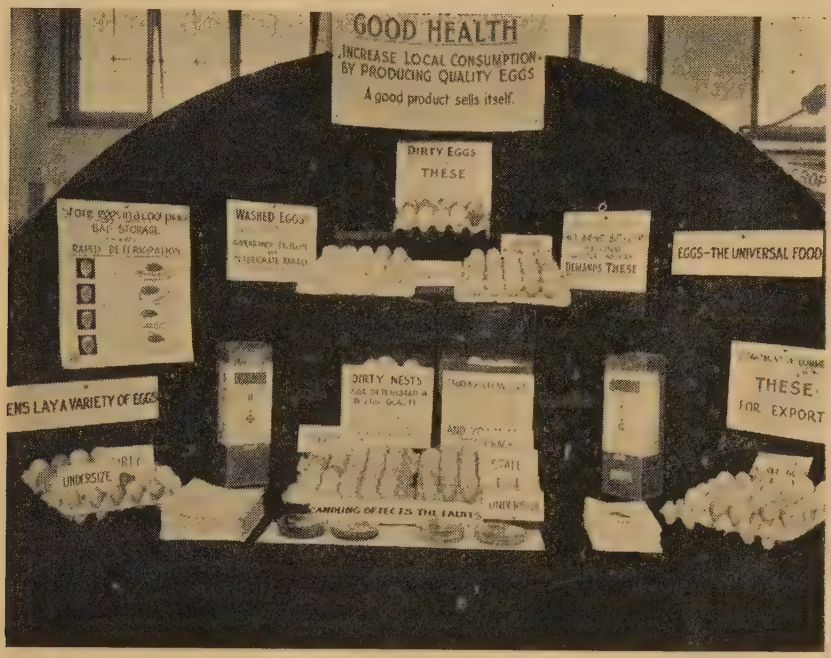
Collections of fresh vegetables illustrated the most desirable features of better known varieties and typified results of present day methods of vegetable culture. The importance of fresh vegetables in our diet was stressed by cards showing the relative value of each with regard to its vitamin, mineral and energy content.

"Don'ts" in potato harvesting and recommendations for guarding against potato moth in storage were displayed. A sample of potatoes which complied with grade 1 standard was contrasted with one below the requisite grade specified by the State potato grading regulations.

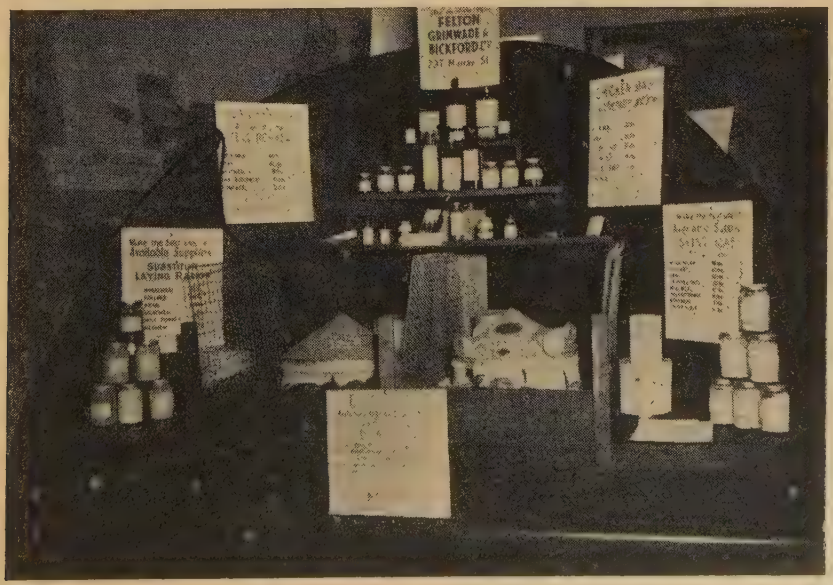
The sides of a triangular stand were utilised by the Apiculturist to display three aspects of the honey industry. One side was used to show honey in glass jars in the commercial sizes along with a number of fancy jars and two fully capped full-depth frames and one half-depth frame of honey.

The South Australian two-decker hive and attachments which received the first prize awarded at the Victorian Beekeepers' Conference were displayed on another side. Resting on the top of this hive was a two-decker observation hive surmounted by a single frame observation hive of honey and bees.

The remainder of the stand was occupied by two frames, showing brood diseases, one of American foul brood and the other of European foul brood; fancy jars of honey vinegar and several cakes of natural yellow beeswax; show-cases of pests and parasites that attack bee colonies and a number of different methods of wiring frames. A kookaburra moulded in beeswax capped the exhibit.



As shown above, one section of the Poultry Branch exhibit was prepared with a view to firstly demonstrating to producers the type of egg acceptable to the Department of Commerce for export and the advantages of producing clean eggs. Secondly, to sponsor local sales by demonstrating to the consumer measures that are taken to ensure that only first quality eggs are distributed for local consumption.



Male and female chickens of the auto-sexing Legbar breed of fowls were contained in two small model brooders. These chickens were bred at the Muresk Agricultural College from parent stock imported from England. When this stock has been tested thoroughly, it is hoped to distribute it to the industry. Samples of the different feeding materials obtainable in Western Australia were shown and balanced rations suggested for chickens and laying birds. Some poultry medicines and instruments were also displayed.

The central feature of the Tobacco Branch exhibit was a scale model of a tobacco flue curing kiln showing the internal structure, heating and ventilating arrangements, and sticks loaded with cured leaf.

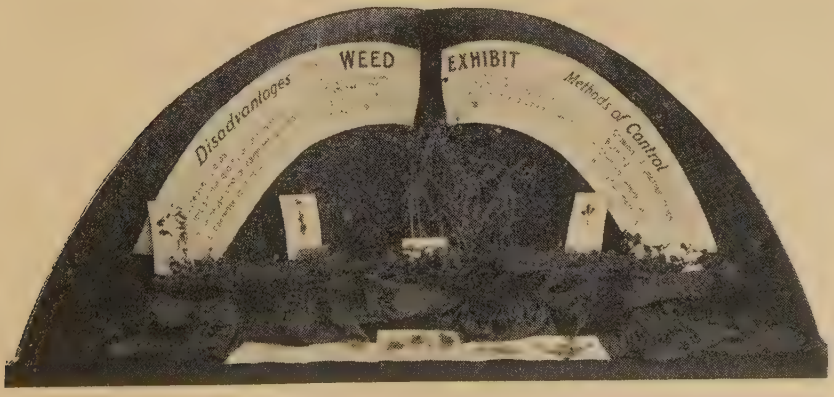
On either side were model seed beds with tobacco seedlings in different stages of growth. Suspended behind the curing kiln were "hands" of tobacco leaf of various grades marked with the prices obtained at the last series of appraisements along with some "hands" showing the effect of "blue mould" disease.

The Plant Pathology exhibit dealt with diseases of cereals, vegatables and fruit caused by both parasitic and non- parasitic agencies. Growing plants were used to demonstrate the effect of pure culture inoculation on the growth of subterranean clover and barrel medic and also the effect of seed protectant dusts on the emergence (germination) of garden peas.

As a direct result of pre-sowing seed inoculation with appropriate rhizobial strains the growth of subterranean clover and barrel medic was increased manifold. Dusting Massey pea seed with Spergon (Tetroc) prior to sowing in old nursery soil increased plant emergence from 5 per cent. to 85 per cent.

The Botany exhibit was devoted entirely to weeds. Growing specimens of hoary cress, St. John's wort, Cape tulip, bind-weed, double gee and water hyacinth were displayed while the pressed material included Bathurst burr, star thistle, Berkheya thistle, caltrop and Paterson's curse.

The many disadvantages associated with weeds were listed along with the main methods of control.



The Vermin Branch exhibit drew attention to the methods of vermin destruction and the necessity for action especially against rabbits, wild dogs, foxes, eagles and emus.

Samples of rabbit poisoning materials were displayed and also a dingo trap with captions indicating its main features and preparation prior to setting.

Mounted specimens of the wedge-tail eagle and dingo respectively occupied prominent positions in the exhibit. Details of the numbers destroyed and bonus payments from the Vermin Act Trust Fund made for the various types of vermin during 1946-47 were indicated on cards. Such payments totalled approximately £22,500 for 14,000 wild dogs, 34,000 foxes, 4,000 eagles and 8,800 emus.

The photographic exhibit prepared by the Soil Conservation Service was arranged to depict some phases of soil erosion in Western Australia and some of the methods now used to control and prevent erosion and improve soil fertility.

One part of the exhibit, a group of ground photos (Fig. 1), showed aspects of erosion and control in Western Australia with emphasis on the value of pasture. The landscape in hilly country is at the Muresk Agricultural College. This area was actively eroding, but has been stabilised by pasture for several years. In preparation for future cropping some of this steep land has now been laid out in a system of graded banks such as those shown in Fig. 3. Such a system shortens the length of run off directly downhill and carries excess water slowly off the paddock with far less soil movement. This mechanical protection to the soil is,

however, only complementary to the great improvements in soil condition and capacity to absorb water rapidly, which can be expected following a period under good pasture. These are prime factors in preventing erosion.

Fig. 1

Three groups of aerial photographs formed the second part of the exhibit (Figs. 2, 3 and 4.) Aspects of water erosion in Western Australia (Fig. 2) were demonstrated, particularly the tendency of uncontrolled gullies to branch and make

Fig. 2.

paddocks costly to work. Methods of conservation farming shown in Fig. 3 are —(i) systems of graded banks; (ii) contour working (at bottom on right); (iii) one phase of gully control; (iv) an indication of the future pattern of farming

SOME METHODS OF CONSERVATION FARMING
GRADE BANKS ON PART CLEARED STONY SLOPES
CONTOUR WORKING BANKS SOIL · CUTS POWER COSTS.

Fig. 3.

where soils, slopes and rainfall dictate the need for contour farming, with or without systems of banks; and (v) a hint of the possible need for alterations in farm layout.

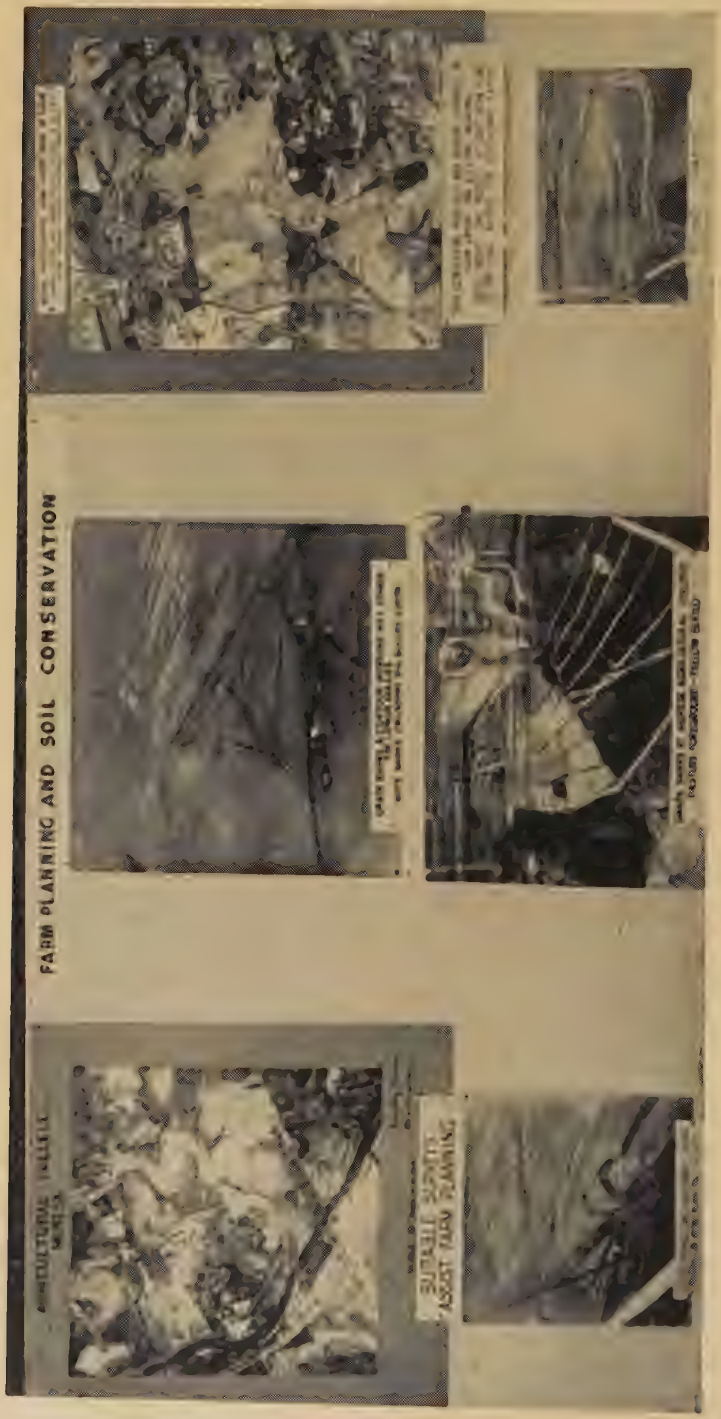


Fig. 4.

The pavilion also contained exhibits prepared by the Stock and Entomology Branches but unfortunately photographs of these could not be obtained.

The aerial photographs are the work of the Kingsley Watson Aerial Photographic Survey Unit and several are published by courtesy of Mr. Kingsley Watson. The remainder of the photographs used in this article were prepared by the Government Printer.

A Handy Aid to the Clearer

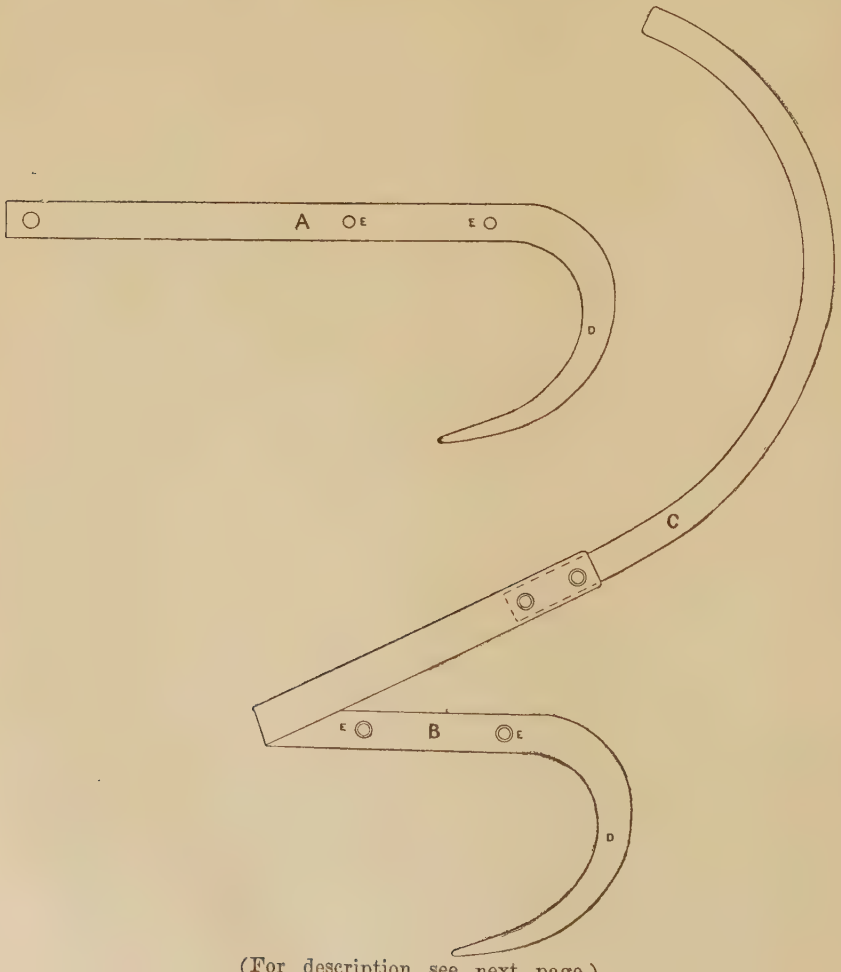
by V. B. Monti, Dairy Supervisor.

THE implement illustrated was invented and developed by Mr. Cedar Armstrong, of Bramley. The second aid is a quiet horse with the ability to pull steadily and straight without swing. With this combination it is possible to make up to 100 pulls an hour on re-growth varying from an inch to 3 inches in diameter. The best results are obtained after the soil has received a good soaking with the winter rains.

The device consists of a central beam of ½" x 1¼" spring steel terminating in a pointed foot similar to an elongated cart hook. To either side of this is welded a similar foot with a shorter beam, the feet being off set slightly so that there is a space of an inch between each of the three prongs at the points. Inch by three-eighth inch upswept iron handles welded or bolted on to the beam and ring to attach the snig chain completes the device. Two old rubber inflations on the ends of the handles will save the hands a lot.

The setting of the beam and the angle on the bottom of the foot is important for it is necessary that, when the power is applied, the implements tends to dig itself in rather than lift out. The points should be made sharp and kept in that condition.

It is used by merely placing it a few inches to the rear of the plant required to be extricated. When used against a small sapling the machine is held slightly sideways to clear the handles. If the diameter of the sucker is small it will tend to wedge between the claws as in drawing a nail with a hammer, and if larger two or more of the claw points will dig into it providing a firm hold. If the teeth tend to spread a clamp may be affixed not less than six inches from the points.



(For description see next page.)

The ease and speed with which this handy little device may be used after a little practice should commend it to any person with clearing or cleaning up re-growth to do. The same principle with the claws set wider apart and a duck foot type of point is suitable for pulling rushes and sword grass in creeks and swamps.

A. Centre beam (½" x 1¼" spring steel) has an overall length of 2' 6" measured on the outside curve. It is straight for 1' 5" from the front end, then curves in such a manner that the points are brought back under the beam opposite a point 1' 2" from the front end, the points are then 6½" below the underside of the beam. The snig chain (approximately 6' long) is attached to the ring at the front end of the beam.

B. Illustrates one of the two side pieces which are welded or riveted to the centre beam "A." These are 2' 4" overall length to the junction of the handles; or, 1' from the end to the junction with "A," and 1' 4" from there to the point, measured on the outside of the curve. The three points should be not more than 1" apart, and should gradually come together in the manner of a claw hammer at least 6" back from their tips. These side pieces are also of ½" x 1¼" spring steel, and the ends to which the handles are attached are slightly off set from the centre beam so that the handles will be about 9" apart at the tips.

C. Curved handles (1" x ⅜" steel) attached to the side pieces, 2' 2" overall length including the joint and measured on the outside curve. The ends of the handles are 2' 6" above the points, and are 6" behind the perpendicular from the points when the machine is held in its normal position.

D. Curves terminating in points.

E. Holes for riveting frame together.

Waters for Agricultural Purposes in Western Australia

Officers of the Department of Agriculture and the Government Chemical Laboratories.

Water for Stock.

THE nature of water which stock will drink varies greatly with circumstances and conditions. In this State, the variation between the summer and winter salinity of the same water supply may be very great, and if stock have been accustomed to watering from one source the gradual increase of salinity which occurs with increasing summer concentration, may pass unnoticed by the animals, who become accustomed to it and suffer little ill effects. If, however, stock which have been accustomed to drinking fresh water, are suddenly put on to a very salt supply, it may be quite distasteful to them, and they may either refuse to drink it or suffer ill effects from its use. Stock, if thirsty through travelling, or under extreme conditions may take and thrive for a short period on a very saline water from which they would suffer if used continuously.

Such factors as these make the question more complicated than at first appears, and although certain standards of composition are recorded, their application cannot be entirely rigid. Water containing less than 300 grains total salts per gallon can be used continuously by all farm livestock. Sheep can tolerate water which is much more saline than that suitable for cattle, and cattle are more resistant than horses and pigs.

The safe upper limits of total salts in water for stock at present in use in this State are:—

	Grains per Gallon.
Poultry	200
Pigs	300
Horses	450
Cattle (Dairy)	500
Cattle (Beef)	700
Sheep	900

(437.5 grains = 1 oz.)

When the total salts exceed these amounts, only practical tests will show whether the water can be used without ill effect, because varying conditions vary the allowable maximum amount of soluble salts.

Where green feed is available, the animals can tolerate more saline water than when "bush or scrub" is the only feed. Sheep have been known to live on water containing up to 1300 grains per gallon of total salts for short periods, but success cannot be forecast with water so saline. Further, older and dry sheep can tolerate waters more saline than can young, growing sheep (weaners) or breeding ewes, and similarly for other stock. Horses not at work can be kept alive on a more saline water than can horses at work.

As indicated in the table, dry or beef stock can tolerate a more salty water than can milking cows, but the milk production of high yielding milking cows will be adversely affected by much lower salt concentrations than 500 grains per gallon.

Although a water may be too saline for use alone, it may be mixed with good water to lessen the drain on the good supply, e.g. when water carting is necessary. The proportions for mixing can be calculated from the soluble salts content of the two waters.

Mixing with a fresh water is the only practical and economic method at present available for utilising saline waters.

Water for Irrigation.

The use of water for irrigation and domestic gardens is influenced not only by the amount of saline material dissolved in the water, but also by the type of soil and drainage, the climate and the rainfall. Much of the unsuitability of saline waters is due to the accumulation in the soil of the salts from the water applied.

The following remarks should therefore be taken only as a general guide, and it is emphasised that where the waters approach the maximum salinity for particular plants or where there exists special conditions of drainage, soil types, rainfall, etc., only practical tests will indicate the suitability of the water for the use in question. A more saline water can be used successfully on a well-drained light soil than on a poorly drained heavy soil. Similarly a more saline water can be used in districts of high, though seasonal, rainfall, as the rain washes down the salts accumulated in the soil.

In general, where the drainage is good, water containing up to 70 grains total salts per gallon is suitable for growing all types of plants, including the salt susceptible plants.

Water containing up to 150 grains total salts per gallon, is suitable for growing most plants other than those susceptible to salt. Water containing up to 220 grains total salts per gallon, has been used for growing tomatoes, lucerne and cabbage and other salt resistant plants.

Above these limits, care should be taken to observe closely the growth and condition of plants or herbage, and if considered necessary, to obtain advice from the officers of the Agricultural Department.

Generally, however, 220 grains of total salts per gallon is regarded as approaching the maximum for safe watering of any plants. With such salt content, the drainage should be excellent and each watering should be of sufficient quantity to leach accumulated salts to a level below the root zone.

In the case of nearly all underground waters, it is advisable to apply by furrows or by flooding rather than by sprinkling.

Salt tolerant plants.

Asparagus, beetroot, cabbage, cauliflower, celery, couch grass, cucumber, lucerne, mangels, melons, pumpkins, rhubarb, silver beet, tomatoes, Wimmera Rye grass.

Salt susceptible plants.

Apricots, carrots, citrus, French beans, grape vines, maize, parsnips, peach, peas, potatoes, radishes, and seedlings.

General.

1. For general domestic use and for human consumption on individual farms the safe upper limit of total soluble salts is considered to be 150 grains per gallon. Water containing up to 300 grains per gallon may be used for showers and baths especially if a salt water soap is used, and water containing up to 700 grains per gallon may be used in a septic tank system.

2. Acid waters have a rapid corrosive effect on iron, such as pipes and tanks, and acidity should be corrected by the addition of good quality builders lime.

3. Acid waters may contain iron in solution and the addition of lime to correct the acidity will throw this iron out of solution as a sludge, which should be allowed to settle and the clear water used.

4. Water may contain sulphuretted hydrogen, a poisonous gas with a very objectionable odour similar to that of rotten eggs. This gas can be removed by aerating the water, the most convenient method usually being to allow the water to splash freely into the tank.

5. The clearing of muddy water by settling can be assisted by the use of kopi, powdery gypsum, at rates up to 4 lbs. per 1,000 gallons of water, or by the use of good quality builders lime at rates up to 4 ozs. per 1,000 gallons.

Samples of water for Stock, Irrigation and Domestic purposes, are analysed by the Government Chemical Laboratories, Adelaide Terrace, Perth, on compliance with the following: —

1. Each sample should:
   (a) be approximately one pint of water in a clean container which has been previously rinsed with the water to be tested.
   (b) be clearly marked with the sender's name and address;
   (c) be securely packed and addressed as above.

2. At the same time, a letter should be forwarded stating:—
   (a) that the applicant is a bona fide farmer, market gardener, grazier, etc., and that the analysis is required in connection with his business as such;
   (b) the source of the sample e.g. bore, well, spring, etc., and its depth, and the location number of the property from which the sample was obtained;
   (c) enclosing the fee of 5s. per sample. This fee applies only to those who qualify under paragraph 2 (a), otherwise the fee is 15s. per sample.

Should the analysis be required very urgently, this should be stated in the letter and the cost of a telegram added to the fee, when a telegram will be sent immediately the analysis is completed.

CAPE TULIP.

G. R. W. Meadly.
Assistant Government Botanist.

SUMMARY.

Two species of Cape tulip, *Homeria collina* (Thunb.) Vent.* and *H. miniata* Sweet, native to South Africa, are now serious weeds in many parts of Australia. They were introduced originally as garden plants.

Both species are toxic, all parts of the plant being harmful, both when green and dry. A glucoside and an alkaloid have been isolated from different species of Homeria.

Stock accustomed to grazing on areas infested with Cape tulip are seldom affected, probably because they avoid the plant. The most serious losses have been experienced among animals brought from a district free of Cape tulip to one in which this weed occurs in quantity.

Chemical sprays have not proved very successful and the most effective control measures are grubbing and ploughing. The time for carrying out these operations is governed not so much by the seeding of the weed as the formation of new corms and cormils. This usually commences at the beginning of August.

INTRODUCTION.

Cape tulip is the name applied to *Homeria collina* (Thumb.) Vent.* and *H. miniata* Sweet, two species which are widespread in this and other States of Australia. Both are native to South Africa where several other species also occur.

As early as 1859 *H. collina* was catalogued as a garden subject in the Adelaide Botanical Gardens and by 1890 both species were established as weeds in South Australia, Victoria, and Western Australia. Their appearance in New South Wales followed shortly after that date.

Cape tulip provides one of many examples of a plant introduced for ornamental purposes soon becoming a serious weed. It has been declared a noxious weed for the entire State.

* Probably more correctly *H. Breyniana.*

Although the extent of infestation in some districts makes eradication impossible, much can be done to control Cape tulip in those areas. Where only small, isolated patches occur, however, complete eradication can be effected. Early recognition followed by prompt action can prevent a few plants from originating a heavy infestation.

A. Homeria miniata. Two-leaved Cape Tulip.
B. & C. Homeria collina (C. seed vessel). One-leaved Cape Tulip.
[Drawing by C. A. Gardner.]

DESCRIPTION.

Homeria collina has a single, ribbed, grass-like leaf 12 inches or more long arising from a corm (the so-called bulb) which is surrounded by brown fibrous material. The stem is shorter than the leaf and produces a few flowers which are, at first, enveloped by green spathes. Each flower has six segments which are usually predominantly pink with a green or yellow base, but are sometimes entirely yellow. The flowers often exceed an inch in diameter. The narrow cylindrical seed vessel opens at the top to liberate numerous brown seeds. The name one-leaved Cape tulip is often applied to *H. collina*.

Homeria miniata has two or sometimes more grass-like leaves and in consequence is often referred to as two-leaved Cape tulip. These arise from a corm around which are formed numerous cormils (small "bulbs"), the whole being surrounded by dark fibrous material. The flowering stem gives rise to a number of flowers which emerge from green spathes. Each flower has six segments, pink in colour with the exception of the yellow base which is often blotched with green. The diameter of the flower seldom exceeds one inch. During the later stages of growth groups of cormils are formed in the angles formed by the leaves and the stem. Although *H. miniata* flowers freely, no plants bearing seeds have been noted in this State.

DISTRIBUTION.

Cape tulip now occupies several thousand acres of land in Western Australia and will monopolise many times this area unless active control measures are taken. It is known to occur from Mingenew to Manjimup and Albany and as far east as Kulin and Merredin.

The main centres of infestation are:—

1. Metropolitan area and environs including Osborne Park, Maylands, Cannington, Bayswater, Bassendean and Bullsbrook.
2. An area extending from Northam to York, Beverley and Mt. Kokeby.
3. Williams and Kojonup.

TOXIC PROPERTIES.

Cape tulip is not only significant as a weed but as a poisonous plant. Mackenzie (1910) found that the corm of *H. miniata* contains a glucoside, which has a digitalis-like action on the heart, raises the blood pressure, constricts blood vessels, and has an action similar to curare on voluntary muscle. He states that this glucoside is probably the active principle. Rindl (1924) isolated an alkaloid, homeridine, from the dried stems, leaves and flowers of *H. pallida* Baker and states that Dixon found that this alkaloid had pharmacological actions on the circulation similar to those of digitalis.

There is evidence to show that the poison occurs in all parts of the plants irrespective of whether they are fresh or dry.

Pappe (1857) describes a case of poisoning among natives due to eating the bulbs of *H. collina* and there are many references to losses of animals. Deaths are reported most frequently among cattle, although horses and sheep are also affected. A dose of 2lb. of green leaves caused fatal haemorrhagic gastro-enteritis in a calf in an experiment carried out by Hindmarsh in June, 1929, (Hurst 1942), while Steyn (1934) found that 220 gm. of the fresh bulbs and leaves in the flowering stage caused the death of a full grown sheep about thirty hours after administration. Similar properties can be assumed for *H. miniata.* Filmer (1926) fed two pounds of chopped leaves of this species to a cow which was found dead the next day.

Stock accustomed to grazing in areas infested with Cape tulip are seldom affected, probably because they avoid eating the plant. Even under these circumstances, however, deaths occur from time to time. The most serious mortalities have been experienced among animals brought from a district free of Cape tulip to one in which this weed is present in quantity. On many occasions deaths have occurred within a few hours.

Although, as mentioned previously, in a controlled experiment, Steyn in South Africa killed a sheep with approximately one half pound of the plant, there is no indubitable record of sheep having been poisoned in this State by Cape tulip.

Clarke (1939) describes the symptoms as partly those of an acute gastro-intestinal irritant and partly those of a cerebral depressant or narcotic. Examples of the first are abdominal pain, diarrhoea, and, if large amounts of green leafy material have been ingested, distension of the stomach with gas, the symptoms increasing in severity and resulting in colic, frequent scouring, great weakness and prostration. The nervous symptoms are indicated by dullness and depression.

Deaths may occur rapidly, within twelve hours or less after ingestion, or the animals may linger for several days.

Carne, Gardner and Bennetts (1926) describe lesions of intense gastro-enteritis and cardiac haemorrhages revealed by a post mortem examination of a bull poisoned by Cape tulip.

PROPAGATION.

Besides the production of a large number of seeds by the single leafed species, Cape tulip reproduces itself vegetatively, the details varying with the species. *H. collina* normally produces two corms of unequal size above the old withering corm, while *H. miniata* may give rise to several corms along with a considerable number of smaller structures known as cormils. Again, in *H. miniata* similar clusters of cormils are formed in the angles between the leaf base and the flowering stem.

There is no doubt that, particularly in the earlier days following its introduction, much of the spread of Cape tulip was due to its ornamental nature. Home gardeners, with every good intention, gave corms to friends, but this plant seldom remained confined to the garden boundaries and soon became abundant in localities suited to its growth. Even in recent years Cape tulip has been spread by this means.

Other agencies which have played their part in its dissemination include stock and vehicles, machinery, agricultural seeds, packing and nursery products such as balled fruit trees.

There is little risk of Cape tulip seeds occurring as impurities in graded agricultural seeds, but on several occasions both seeds and cormils have been found in subterranean clover burr and threshed, ungraded seed. Apart from any other consideration this provides ample reason for purchasing cleaned seed.

Straw packing represents a potential source of any weed and Cape tulip corms and cormils have been found in soil forming the balls around fruit trees being distributed from a nursery.

CONTROL.

Any control measures carried out against Cape tulip must be designed, not only to prevent seed formation but also to forestall the development of new corms and cormils. Observations carried out by the author in 1930 and subsequent years have shown that the development of new corms commences about the beginning of July, at which time the food reserves in the old corm are largely exhausted. Cashmore (1938) using pot-cultures found that the first evidence of new corm production occurred during August and early in September.

As, normally, full flowering does not occur until mid-September and seeds are not mature until a month or more later, the time of corm, rather than seed formation influences the initiation of control measures.

An effective chemical spray would provide a very convenient method but unfortunately, various chemicals have been tried in this and other States with little success. Experiments conducted by this Department proved a single application of sodium chlorate, atlacide and sulphuric acid to be ineffective, and Davies (1942) reported that the Council for Scientific and Industrial Research after six years of tests with various chemicals failed to secure satisfactory results with Cape tulip along with a number of other perennial weeds. Many chemicals, including dieselene, will kill the top growth but do not penetrate to the corm, and in order to obtain any appreciable reduction in the stand, it is necessary to spray several times each year, an undertaking only practicable for very limited areas. Unless the plants are growing in inaccessible places such as among rocks, grubbing must be considered a more satisfactory method.

The most effective means of control are grubbing and cultivation, the latter often being associated with a cropping programme. Where the areas are small or the plants scattered, grubbing is possible, but where appreciable areas are heavily effected, ploughing is more practical. Unless grubbing is carried out at the beginning of August or earlier there is every chance that new-season corms or cormils will have been formed and remain in the soil when the remainder of the plant is removed. When the flowering stage is reached the basal corm development is well advanced and grubbing at this stage often serves to distribute the weed rather than reduce infestation, unless extreme care is taken to remove the entire plant. If cormils are present, the surrounding soil as well should be removed and all placed in a bag or tin for disposal. All plants grubbed should be destroyed by burning.

The same principle must be applied to ploughing which should be carried out to the depth of the corms in July or early August. If the ploughing is done early in the season the old corm may still contain sufficient food reserves to initiate further growth while if delayed too long mature corms and cormils will have been produced. The vulnerable period is comparatively short and naturally varies somewhat with the season. The best method of ascertaining this period is to examine the plants and observe the relationship between the old and new corms. The importance of the time factor relative to cultural operations cannot

be overstressed and these should be carried out when the food reserves of the parent corm are almost exhausted and the new corms have not developed to the extent of being capable of independent growth. A further spring cultivation may be advisable depending on the regrowth of the tulip, but a summer working increases the cost of control measures without giving corresponding benefits.

In South Australia the single-leaved species has been controlled over an area of 500 acres by ploughing or cultivating at the critical period in three consecutive years. Similar results have been obtained on a smaller scale in this State.

In districts where stock are accustomed to the plant and seldom affected by it, good results have been secured, at the same time deriving some return from the land, by sowing an early maturing crop of oats, grazing heavily until the beginning of August and then ploughing. This practice is more suited to the Great Southern than the lower South-West. Sometimes it is possible to make a late sowing of a cereal following the ploughing in June or July and ground that is moist in the summer can be utilised for crops such as Japanese Millet and Sudan grass.

A difficulty is presented by the fact that some soils on which Cape tulip thrives are too wet to carry heavy machinery when the weed is at the vulnerable stage. Under these conditions it is often possible to use horse drawn implements for comparatively small areas. The alternative is to plough early and then, if possible, cultivate at the optimum time.

Although an appreciable reduction in the quantity of Cape tulip can be expected at the end of the first year's operations, active measures must be pursued for several years in order to cope with delayed germination of seeds and development of corms.

Repeated mowing to prevent flowering will arrest the spread of Cape tulip, although no experimental evidence is available to show whether the density of the infestation is reduced by the operation. Chipping with a hoe will also prevent seed formation but is essentially a measure of control rather than of eradication.

Thoroughness and persistence is required for the control of all perennial weeds and Cape tulip is no exception. A few plants allowed to seed will nullify much good work, and repeated inspections to detect further plants represent an important part of any programme directed against this weed. Spectacular results cannot be expected, and any scheme necessitates carrying out systematic measures for a number of years.

In compiling the information concerning control measures, I have been assisted greatly by discussions with Professor H. C. Trumble and Mr. A. J. K. Walker of the Waite Agriculture Research Institute, South Australia. As the result of a request from the Weeds Co-ordination Committees recently reconstituted in each State the Waite Institute has undertaken investigations into various aspects of Cape tulip control. This is an Australia-wide project and the Department of Agriculture is co-operating with Professor Trumble and Mr. Walker as far as Western Australian aspects are concerned.

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THE FRUIT INDUSTRY IN W.A.

H. R. Powell, Superintendent of Horticulture.

THE fruit industry (as most people know) is a very extensive one, our congenial climate permits the growing of a great range of fruits. Apples and pears grow in the hills districts and lower Great Southern and South-Western districts. Such towns as Mt. Barker, Donnybrook and Bridgetown are perhaps as well known as the apples, which are grown in the well-kept orchards surrounding them. Western Australia is one of the leading apple producing States of the Commonwealth—one State only, namely, Tasmania, produces more. Last season the apple crop approached 2,500,000 bushels—a record crop certainly, but on the other hand crops of this magnitude can be expected to occur again every few years. There are approximately 11,200 acres planted to apple trees in the favoured districts which are many miles apart.

A favoured district must possess congenial soil and climatic conditions to produce good quality fruit. Sometimes continued dry weather during the growing season causes havoc by restricting normal development. Apple trees become stressed for want of soil moisture and thus the fruit cannot come up to proper size. Hot and dry weather, too, during critical months of growth, can cause enormous damage to susceptible varieties by inducing pre-harvest drop. Early last March, at the commencement of the harvesting season, one-third of the total crop

of Jonathans fell to the ground during one week-end. Fortunately, there are certain growth hormones that can be used to prevent pre-harvest drop. Commercial supplies are available here and full details are available as to how to use them. The spray should be applied to the trees several weeks before the time the critical weather conditions are expected. In the Eastern States the hormone spray is very effective in preventing the premature fall of Bartlett pears.

Granny Smith 2¾in. apple seen at Singapore affected with "scald" in association with sun-burn injury.

Photo: H. R. Powell.

In addition to the losses caused by fruit drop, damage can be caused to the fruit by direct sunburning. During severe hot weather some fruit can be actually cooked on the trees. This obviously defective fruit is never packed but many apples, slightly sunburnt, are often packed by growers. For immediate local market consumption no great harm is done—the fruit is quite edible and the only defect is a yellowish discolouration of the skin. It is another story when it comes to late-stored Granny Smiths. After the fruit has been in store for several months the sunburned areas become very susceptible to "scald." This is best described as a dark brownish discolouration of the skin, which does not affect the tissues underneath.

In certain years "scald" is prevalent, and it is always worst on early fruit picked at the stage of greenness desired by overseas buyers in the United Kingdom and Singapore. It was surprising to notice in Singapore that "scald," particularly associated with sunburning, even slight sunburning, developed into a colour almost as black as ebony. This development is perhaps due to the different climatic conditions, but there is no doubt that this disorder can become a major defect with late stored Granny Smiths. Some little time ago one Singapore shipment turned out badly as far as "scald" was concerned. This made buyers nervous, and a subsequent shipment brought comparatively poor prices due to a fear that this disorder would be prevalent again.

The climate again can affect fruit quality—this time rain, when Granny Smiths are being picked and packed—can make the fruit very susceptible to bruising.

In Singapore, too, bruising is regarding as a major defect and recently large sizes, 2¾ and 2½, were seen that were particularly badly affected. When things become normal again trade will not be so easy with this country and other overseas markets as it is now. Fruit will come in freely from other sources. The American season does not commence until July-August with fresh apples, Gravensteins, but it is possible for American exporters to secure most of the apple trade in Singapore after that date as they did with "Sunkist" oranges before the last war.

South Africa, too, is becoming a serious competitor with oranges and it was learnt recently that apples will be sent to Singapore this season. During the pre-war years South African apples were exported in large quanties to the United Kingdom and there they secured a very good reputation for quality. With rigid control of export fruit, including varieties, quality standards and cold storage, the ships that carry fruit, and a thorough knowledge of the overseas fruit market requirements, the South Africans are capable of seriously competing with Australian fruit on all the world's markets.

There is no reason to be pessimistic at the present time, but equally so it would be foolish to be optimistic, unless cognisance is taken of the danger signals and steps are taken to meet the competition.

To sum up, the two major faults appear to be "scald" and bruising, and there is no doubt that these defects can prejudice present market prospects.

Now for a few words about oranges. The orange districts are so well known that I will not dwell upon them except to say that they extend from Mooliabeenie in the north to Capel and Donnybrook in the south. Production is not large and usually ranges from 300,000 to 350,000 bushels. This quantity, however, is too large to be marketed profitably locally and some export outlets are necessary.

During recent years shipments have been made to Singapore. Unlike apples, however, which meet no competition from fruit produced in nearby countries, oranges from all sources meet very strong competition with mandarins from Siam and China. These mandarins are very sweet and juicy and are very popular with the Chinese. The season for the Chinese mandarin commences at the end of November and extends to March, and the greatest quantities are marketed during January and February. The Siamese mandarin season extends from October to December. During the time under review wholesale prices for Australian oranges were depressed owing to heavy supplies of these mandarins on the market.

Oranges from a number of sources—New South Wales, South Australia, Victoria, our own and cool-stored fruit from South Africa were compared. As far as some Western Australian fruit was concerned the major defects seen

were a yellow colour and a lack of sweetness. The Chinese prefer very sweet fruit with a bright orange colour. It is difficult to see how these faults can be overcome. Ways and means of improving our pack will, however, be discussed with growers and shippers with the hope that a large part of the present trade can be retained.

It must be remembered that the Californian "Sunkist" fruit enjoyed a premium on this market before the war and the trade will be resumed when present financial difficulties are overcome.—(*Extracted from a broadcast by permission of 6WF-6WN.*)

Granny Smith apples are popular in Singapore. Photograph shows importers waiting for their fruit to be unloaded from M.V. Orestes last November.

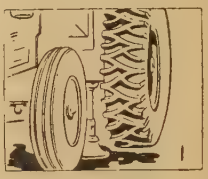
Photo: H. R. Powell.

Water Inflation of Tractor Tyres.

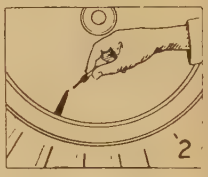
To Water Inflate Your Tyres.

Directions:

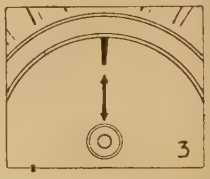
1. Jack the tyre to be water-inflated clear of the ground.



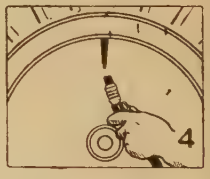
2. Remove core from valve stem. In the case of Special Water Inflation Valve, unscrew and remove valve stems and allow air to completely expel itself from the tyre.



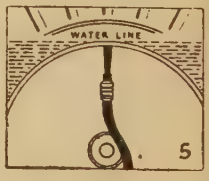
3. Revolve tractor wheel until tube valve is in a 12 o'clock position, that is, directly above the wheel hub.



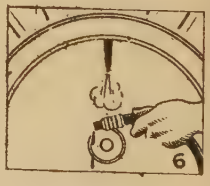
4. Connect water hose to tyre valve with water valve coupling.



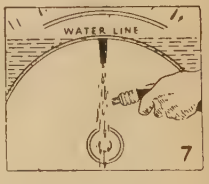
5. Fill the tyre with water up to the valve level while it is in a 12 o'clock position.



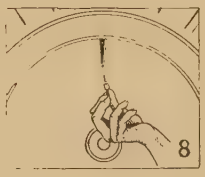
6. Remove water valve coupling from tyre tube valve from time to time to "bleed" the remaining air in the tube, otherwise this remaining air will act as back pressure and prevent the water from entering the tyre.



7. To ensure that you have the correct amount of water-inflation, continue to fill the tyre with water with valve still in the 12 o'clock position, until water flows out of the valve. Allow the surplus water to drain off still keeping the valve in the 12 o'clock position.

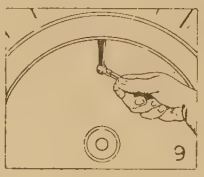


8. When surplus water has ceased to flow from the valve replace the valve core or insertion piece.

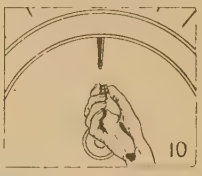


9. Now inflate the part water-inflated tyre with air to the correct pressure.

Minimum: Front Tyres .. 28 lbs.
Minimum: Rear Tyres .. 12 lbs.



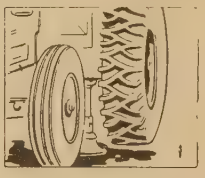
10. Replace valve dust cover firmly and remove jack.



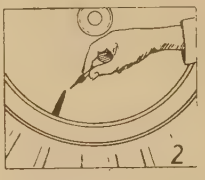
To Remove Water from Tyres.

Directions:

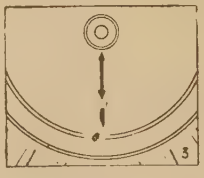
1. Jack the tyre to be drained of water clear of the ground.



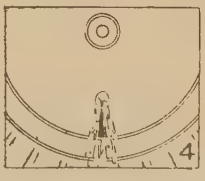
2. Remove core from valve stem. (With special Water Inflation Valve, unscrew and remove insertion piece.)



3. Revolve tractor wheel until tube valve is in a 6 o'clock position, that is, directly below the wheel hub.



4. With valve in the 6 o'clock position, allow water to drain.



Information by courtesy "Dunlop Operation Manual."

THE BRACKEN FERN AND ITS ERADICATION.

M. CULLITY,
Superintendent of Dairying.

Bracken fern is widely distributed over the earth and is probably one of the oldest of plants, dating from cretaceous times. During the long period of its existence it has proved resistant to fungoid and insect attack. Actually in surviving the varying conditions of the changing times, it has proved its adaptability and extreme resistance to haphazard methods of control.

It is a common pest in the south-western portion of this State and throughout many other parts of Australia. In fact it is so common that it is accepted as a permanent resident and frequently no effort is made to control it. It covers hundreds of acres of once cleared land which otherwise could carry useful pastures.

In Western Australia it is gradually occupying increased areas. Its incidence is greatest on those properties with the largest cleared areas and therefore it is easy to understand why more is not heard of the loss of country. In general it may be said that sufficient is known of the methods of control in this State to prevent it from becoming a serious pest on small well-worked properties.

A picture of this plant and its method of vegetative growth and aggression is best given in the words of K. W. Braid[1]:—

"The bracken plant consists of a bulky underground system which extends for many dozens of square yards. Many a patch of bracken is in fact one extensive plant annually producing hundreds of fronds. Possibly even large bracken areas are all one plant, so it is obvious that the whole must be attacked as a unit. Under ideal conditions of good deep soil the subterranean system can be shown to be made up of three or more tiers of rhizomes or underground stems. The lowest tier —the leader—usually runs at a depth of 15 to 25 inches and is the main invading system. It possesses the thickest rhizomes ending in a terminal finger-like bud which periodically produces side buds to right and to left. This is figured in the diagram as A. (fig. 1). The side buds develop into branches which bend upwards and move horizontally in a region above, and if they are within nine inches or less of the surface often bear fronds (B). They also produce subsidiary buds which grow into much thinner, shorter branches, often characteristically zigzagged (C and C1). These approach nearer to the surface and frequently produce fronds in groups. The proportions in which these tiers are produced depend on soil depth and texture and the food ingredients available. Given good friable soil of good feeding quality, tiers A and B are abundantly produced, while if conditions are such as to check these, C develops most. Near the periphery of an area A and B are most abundant and tier C commonest about the centre. If for any reasons the depth of soil decreases, as for example when the subsoil of a rock approaches within seven to nine inches of the surface, all these zones get compressed into one layer overlying the subsoil, but the downward tendency of the terminal bud on A is such that if it reaches deeper soil three or even four tiers will again be exhibited. In all cases the terminal bud of each tier is the most active growing bud. By the division of the terminal cell it gives rise to lateral buds producing either branches or fronds. These may produce buds which may lie dormant for some years. Normally the fronds of each season arise from the side buds immediately behind the terminal buds of tiers B and C, but sometimes subsidiary buds may also develop at the base of these.

"If the frond is destroyed in the green state, the bud destined for next season's frond begins to develop and in addition some of the dormant buds or subsidiary buds develop into fronds."

The fact that the rhizomes are in tiers at varying depths explains how the plant survives the heat of summer. Water in large quantities is needed to replace that lost by transpiration and this can always be obtained by the deepest rhizomes, and with this water it also obtains much mineral food.

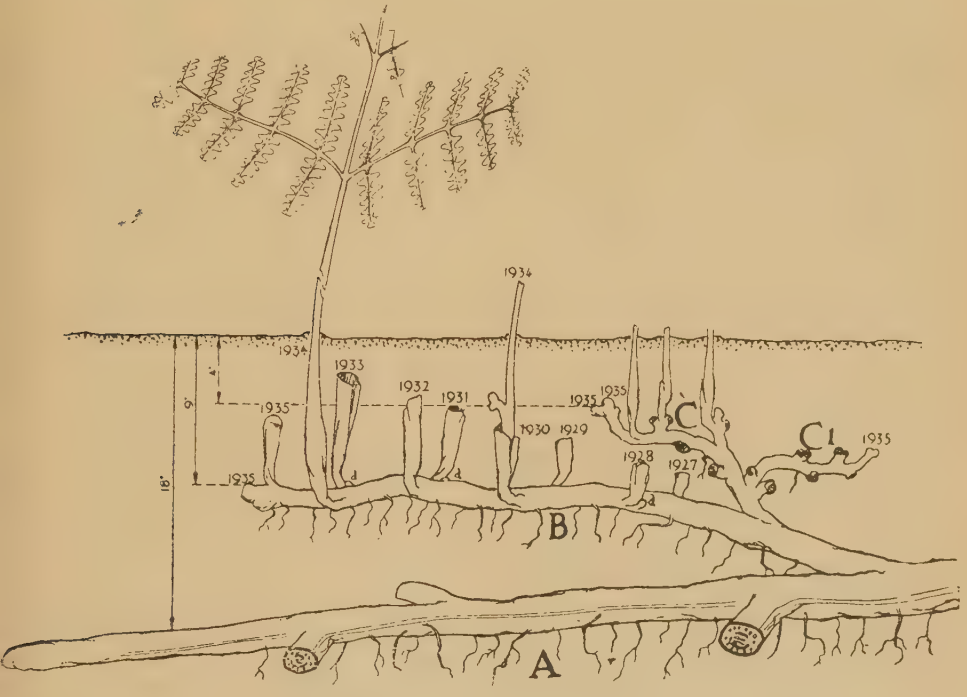


Fig. 1.—BRACKEN: UNDERGROUND SYSTEM IN JANUARY.

A. Main elongating rhizome.
B. Large branch bearing fronds from near apex.
d. Dormant buds. The remains of 1934 fronds extend to surface; those of previous years in various stages of decay. In one case a branch from a dormant bud had grown through an old frond base.
C. Branch of limited growth; fronds as in B.
C1. Except at end only leaf-scars are depicted.
r. Roots.

From the Scottish Journal of Agriculture, April, 1935, *p.* 122.

"The bulk of the rhizome may be enormous, five or even ten or more feet of it lying below each square foot of surface. This is packed with food reserves such as sugars and starch. All these food reserves are manufactured in the fronds from the carbon dioxide in the atmosphere and the water and minerals absorbed from the soil.

"The removal of the fronds therefore (a) prevents the building up of further foodstuffs, (b) exhausts the underground reserves by inducing attempts to produce new leaves. Theoretically (and this is backed by experiment), the best time to destroy the fronds is when they have reached their maximum growth, *i.e.,* when they have drained the rhizome but have not begun to contribute food."

This statement agrees with the conclusion reached from observations in this State, that the optimum time for cutting is at the end of spring when the fronds have made full growth. There is always a smaller crop of young fronds after cutting at this time than after cutting at any other period of the year. Where two cuttings per year are carried out, one in October-November when the fronds are at full growth and another in May-June the depressing effect on the plants is greatest. Cuttings in January, February or March appear to have little effect in reducing the thickness of the succeeding crop. Cutting from May to September results in a fairly large crop of young fronds, but when this is followed by another when the plant is at full growth a greater effect is obtained. It is better to cut early say in August than to delay till February.

That the removal of the fronds will cause a depletion of the rhizomes is confirmed by examinations carried out by Smith[2]:—

"When the rhizomes from the trial holes were examined depletion of the larger storage rhizomes was evident. Those from an uncut area were large and plump and hard for large distances and only old parts showed decay. Rhizomes from the cut plots were shrunk from a short distance behind the growing point, and they contained a milky fluid instead of the firm white tissue of normal bracken."

Hendrick[3] showed by a series of analyses that the amount of food reserves as expressed by soluble carbohydrates and nitrogen diminishes steadily up till the time of maximum growth of the fronds after which there is again an increase.

The starvation of the root system is also demonstrated by the diminishing size of the fronds.

There can be no doubt that the cutting of bracken is the most effective method of attack, but unfortunately this method cannot always be economically applied.

An outline of procedure which it is suggested should be followed is given hereunder. For convenience it is proposed to consider an area of partially cleared country and to follow its progress from a bracken infested area until it is an area of open pasture. A consideration of bracken in virgin country will not be made as in these conditions it cannot be described as a serious pest, and the method of attack necessary to subdue it would be an expensive one. Usually, however, the bracken does not assume the proportions of a pest until some preliminary clearing is carried out allowing more sunlight to reach the areas where the outpost plants are existing.

If it is impossible to commence clearing the area more thoroughly and it is necessary to attempt a reduction in the amount of the pest, the following methods may be applied.

Fire.—In areas such as those under consideration it is possible almost every year to get a fire to go through the paddock burning the dead bracken and at least killing the green fronds. It is more usual to burn every second or third year when a more intense fire and a cleaner result can be obtained. Experience has shown, however, that this method of control is totally ineffective as a means of eradication of bracken unless it is combined with certain other steps. It can only be considered as a method justified by expediency, inasmuch as the pest is not actually checked but the ground is cleared of the dry debris. As a consequence young grass is allowed slightly more space in which to grow, and stock will be able to make their way more easily through the areas so treated. This method is of course usually restricted to large paddocks.

Pasture.—Good results have been obtained by sowing subterranean clover seed on the ashes after a burn as described above, and topdressing with superphosphate. The clover usually is able to make rapid development until such time as the bracken growth and debris again is smothering the area and another fire is needed. This growth of clover entices stock into the area which then assist in counteracting the pest by their eating or trampling the young fronds. Kikuyu-grass is also of value in controlling small areas. Dibbled in about 2 ft. apart each way plants will spread rapidly and cover the ground in one year providing they are protected from stock for this period. The mat of grass will subdue the fern.

Cutting.—A further step which is occasionally taken in conjunction with the above is the use of the fern hook to clear the area periodically. This entails either the gathering of the fern into heaps for burning or recourse to a running fire, to clear the ground. The employment of the fern hook will depend for its efficiency on the time of the year that it is used.

Subdivision.—While the methods referred to above will gradually open up the paddock, the erection of subdivisional fences will assist in speeding up the attack. The trampling effect of the stock by being localised will be more severe, and it will be easier to carry into operation a plan for more offensive methods.

Clearing.—The clearing of the stumps and fallen trees must be carried out before it can be hoped to fully subdue the fern. The ground is then ready for the plough, and it is usual to sow a crop of some sort in order to level the ground sufficiently for the use of the mower. As a means of subduing the fern the plough is not as effective when used before a period of cutting as it is when used after. The deepest rhizomes are untouched and remain vigorous to take up the attack. After a series of cutting the higher rhizomes are weakened and the lowest which usually do not produce fronds commence to grow towards the surface so that the production of fronds may be continued. It can be easily realised therefore that a ploughing after a period of cutting will be much more effective in breaking up the whole of the rhizome system.

Mowing.—The ground after having been ploughed and cultivated will be in a level condition and fit for the use of a mower. The system of attack by cutting can then be carried out with this implement. Unfortunately the optimum time for doing this work coincides with one of the busiest periods on a farm, the harvest. That cutting at this period is effective is proved by the fact that the bracken does not survive if a paddock is cut two or three times for hay.

Old Pasture.—Where it is desired to reclaim old pasture which has been allowed to succumb to the advance of bracken, the method to be adopted will vary according to the density of the growth. Assuming the field to be densely covered it is suggested the best results would be obtained by following the steps suggested hereunder or variations thereof:—

(a) clear the paddock of the accumulation of dead bracken by burning during the late summer.

(b) If subterranean clover is not present sow on the ashes up to six pounds of inoculated clean seed or an equivalent amount of burr per acre, the rate depending on the original density of the bracken. Six pounds per acre will give a complete cover in the first season.

(c) Fertilise with one bag of superphosphate per acre.

(d) Stock lightly, allowing the clover to seed.
(e) Mow the paddock in November even if the hay crop be unsuccessful.
(f) In the following autumn mow the regrowth of bracken, fertilise with superphosphate and allow stock to graze more heavily.
(g) Close the paddock early and cut for hay.

Fig. 2.—Partially cleared country, rendered temporarily useless by a heavy growth of bracken.
Photo—M. Cullity.

Fig. 3.—A fully cleared hillside, completely covered with bracken. Clearing fires have not checked its growth.
Photo—M. Cullity.

The process of cutting twice annually should be continued for two seasons, when the densest bracken will have been severely checked. If preferred after two seasons' cutting, a crop could be sown and the ploughing necessary would be effective in cutting to pieces the weakened rhizomes, which would have drawn closer to the surface.

Other Methods of Attack.

Whipping has been carried out in certain countries, particularly France. There does not appear to be any very definite information available as to its efficiency. There can be no doubt that the bruising effect particularly during the growing period would weaken the root system. As far as can be ascertained the comparative effects of cutting at the optimum time and whipping have never been studied.

Fig. 4.—Subterranean clover growing vigorously amongst bracken.. ' The trampling of the stock has effected a great reduction in the density of the plants.
Photo—M. Cullity.

Rolling.

Much has been claimed for various types of rollers and drags. The latter have been of various types, heavy rails fixed at right angles to the line of draught or fitted together to make a triangle have been used with success. However where these can be used the mower will do a better job.

Rollers have also been of numerous designs, some single round logs, others fitted with blades which have the effect of cutting or crinkling the stalks.

Most types require clean open paddocks, fairly free of stumps and fallen trees, conditions which would be suitable in many cases for an old mower.

A very effective roller has been designed by Messrs. W. J. & S. Rooney of Glen Warren, Manjimup, and which has the advantage of being able to cover large areas relatively quickly. Being tractor drawn more than one roller can be used. A simple method of yolking them was devised and is illustrated in Fig. 5.

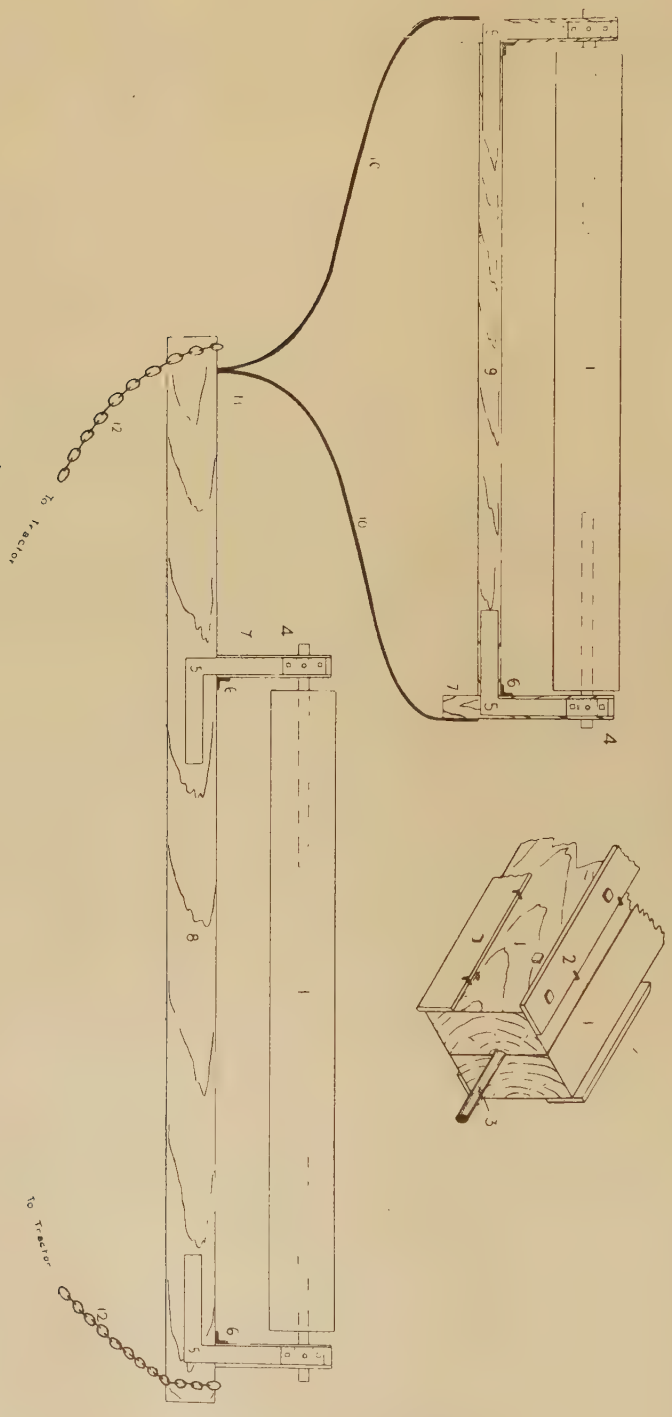


Fig. 5.—DIAGRAM OF ROLLER.

1. Two 9ft. timber sleepers bolted together with four ⅝in. x 12in. bolts.
2. Steel blades. Grader blades where possible bolted through sleepers and fastened by dog spikes. Blades to project from 1in. to 1½in.
3. Axle 1¾in. Can be made from spring cart axle cut in halves.
4. Bearing with grease nipple.
5. Flat angle irons about 3in. x ½in. extending to back of timber frame.
6. 2in. x ½in. angles.
7. and 9. 4in. x 2in. timber frames.
8. 8in. x 2in. timber (karri).
10. Iron frame for roller swivelled at roller end.
11. Connection to beam must be attached in such manner as to allow free movement.
12. Chain connection to tractor.

(Drawing by Department of Lands and Surveys from information by S. Rooney.)

The rollers are square in section being constructed from sleepers bolted together and protected on the cutting edge by steel plates.

Photographs of the tractor and rollers in operation are shown in Figs. 6 and 7. The general method of hitching the rollers to the tractor may be seen while a good impression of the density of bracken is also given.

Fig. 6.—Tractor and rollers. Rolled fern in background.
Photo—C. Rooney.

Mr. W. J. Rooney wrote regarding his experiences—"I am at present busy rolling all the fern paddocks and although they are greatly improved from last season there has been a strong crop of new ferns. Last year I was able only to get through with the tractor by having a man walking ahead and showing me stumps and holes. This time I can see most of them from the tractor.

"Other country rolled last year has responded very well. There has been a particularly good germination of clovers in this district and, although fresh ferns are coming again, they are stunted and scattered compared to what they were.

"I have been putting two rollers behind a 'Farmall H' and with an approximate 15ft. sweep it does not take long to cover a large area. Two horses can pull one roller without difficulty.

Fig. 7.—Tractor and rollers. Approaching high fern.
Photo—C. Rooney.

"In high thick fern the results are spectacular—hardly a fern remains unbroken in two or more places. Where the ferns are small and scattered the percentage knocked down and bruised is smaller. This might be overcome by fitting extra blades and making the roller six or even eight-sided. The four sides and cutting edges, however, are an advantage in rough uneven country as the drag is greater and the blades bite in to some extent. I am under the impression that it would be an advantage to have blades drawn out to a cutting edge, not to cut the fern but to bite deeper and equalise the affect of uneven ground.

"A proper hitch as illustrated is necessary, as otherwise in hilly country, one roller had a tendency to gain and override the other.

"We have tried the fernhook, mower, railway iron, fire and so on but, so far, this looks the most practical method. The mower used often enough does good work, but is limited to clear country. I have had the rollers over boulders, stumps and logs and have even bashed an occasional tree without damaging them."

Pigs.—The use of pigs that have not been nose rung is quite successful. The animals like the succulent roots and will turn over much ground in order to reach them. It is obvious however that their use on a large scale for this purpose is not practicable.

Weedicides.—Much promise was attached to the possibility of attack with weedicides. As the clearing of bracken is undertaken primarily to allow utilisation of the ground for other plants, the selection of a weedicide is limited to those which, while destroying the plants will not injure the soil. Among the substances capable of performing the work the chlorates of sodium and calcium are the most useful. It has been demonstrated by Braid and others that it is possible to get a complete kill, of both fronds and roots by a single application of sodium chlorate. For this purpose a dressing of not less than two hundredweights per acre is required. As the chemical is high in price this method is, temporarily at least, prohibitive. Another system is the application of sodium chlorate direct to the cut stalk of the frond by the use of a piece of sponge rubber saturated with a solution of the chemical, attached to the blade of a scythe or to the cutter bar of a mower. This system is claimed to be fully effective and uses only a small amount of the chlorate.

Fig. 8.—Bracken being beaten back from pasture. In the foreground the clear space has been mown for hay during the past two seasons. The headland along the fence is still carrying vigorous plants. In the background the fern has been cut by the mower.
Photo—M. Cullity.

However there is no record of the method having been used in Western Australia. Interest has also been shown in the use of one of the hormones as a selective weedicide, but no information regarding its effectiveness is as yet available.

References:—
[1] K. W. Braid—"Scottish Journal of Agriculture," Vol. XVIII., No. 2.
[2] W. G. Smith—Trans. Bot. Soc., Edinburgh.
[3] J. Hendrick—Kew Bulletin, No. 4, 1921.

RESPONSES OF WHEAT TO COPPER AND ZINC AT DONGARA.

By T. C. DUNNE, Plant Nutrition Officer, and
G. L. THROSSELL, Agricultural Adviser.

IN 1942, Teakle reported increased yields from the use of copper and zinc applied together in a trial supervised by Davenport at Dongara. In this instance, the use of these elements increased the yields of wheat from 12.2 bushels (with superphosphate) to 14.6 bushels. The increase was statistically significant. Equal improvement in yield was obtained from the use of ground roaster residues which contain both zinc and copper, used at the rate of 200 lb. per acre.

No further data were obtained until 1947 when it was possible to accept the offer of a Dongara farmer to assist in conducting the further experiment which is reported hereunder.

EXPERIMENTAL SITE.

The site of the experiment was on a fine loamy sand, dark grey-brown in colour and very high in lime (41-58%). The pH value of both the surface (0-6") and subsurface layers (6-12") was 8.5. The area, which was originally covered with a heavy growth of wattle (*Acacia spp.*) and various climbers, was cleared in 1940. Since that time, three cereal crops had been grown. Neither copper nor zinc had been previously used on the site chosen, although copper fertilisers had been used on other parts of the property.

CULTIVATION AND SEEDING.

Following weed germination by April rains, ploughing to a depth of three to four inches was done in May, 1947. No further pre-seeding cultivation was necessary and seeding was done on June 8th and 9th with a combined cultivator drill.

Ranee wheat was sown at the rate of 60 lb. per acre.

FERTILISER TREATMENTS.

The layout used consisted of five blocks each containing seven randomised treatments giving thirty-five plots in all. Each plot covered .1 acre, being one drill-width wide (sown wheel on wheel) and 625 links long.

It was decided to use zinc (Zn) and copper (Cu) with superphosphate, both singly and together. A further treatment included the use, in addition, of manganese (Mn), magnesium (Mg), borax (B) and molybdenum (Mo). Another variation, because of the high lime content of the soil, was the addition of potassium (K) to this superphosphate-"minor" element mixture. Finally, because of the relatively high phosphorous (P) status of the soil as compared with most soil types in the State, one treatment consisted of all mineral elements tested but without superphosphate.

The fertiliser mixtures used therefore were as follows:—

Treatment.	Fertiliser.
A	Control—superphosphate 112 lb./acre.
B	Treatment A plus copper sulphate 10 lb./acre.
C	Treatment A plus zinc sulphate 5 lb./acre.
D	Treatment A plus copper sulphate 10 lb./acre. plus zinc sulphate 5 lb./acre.
E	Treatment D plus magnesium sulphate 20 lb./acre. plus manganese sulphate 10 lb./acre. plus borax 5 lb./acre plus roasted molybdenite 4 oz./acre.
F	Treatment E plus sulphate of potash (30%) 56 lb./acre.
G	Treatment F minus superphosphate.

SEASONAL GROWTH.

Seasonal conditions were good. Weed growth had been controlled by the initial ploughing and planting was done under excellent conditions. With the exception of a relatively dry August the rainfall was very good until the end of October. Following are 1947 rainfall figures in points for Dongara:—

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total May-Oct.	Total Jan.-Dec.
2	0	1	132	373	396	416	112	189	413	48	4	1899	2038

In the early growth stages, the plots receiving the more complete minor element mixtures, i.e. treatments E, F and G, were retarded. This effect was overcome by August and it will be seen later that one of these viz., treatment F, finally gave the highest yield though not significantly greater than treatment D.

Plots which did not receive zinc (treatments A and B) showed progressively poorer growth than the others. Withering of leaves, which gradually became more pronounced developed in July. Leaves of plants showed a yellow to light green striping a little inward from the edges. In mid-September, when the plants were heading out, those without zinc were 6-12in. shorter than other plants. Maturity was delayed about two weeks.

Copper did not appear to improve growth. At the September inspection there was no definite growth difference between the plants of treatments A and B or between the plants of treatments C and D although eventually there was a substantial difference in yield between C and D treatments. However, as maturity approached the plants without copper showed weakness in the straw about six inches below the ear. This caused the ears to bend over and in some cases to hang parallel with the stem.

By mid-September, the addition of potash in treatment F had given increased growth as compared with plants which had received the mixture of all other elements (treatment E). However, the plants of treatment G which received potash and all other elements except superphosphate, were not as well grown. At this stage, therefore, superphosphate had also given benefit.

YIELDS.

Yields generally were satisfactory and in some instances surprising. In this connection it was demonstrated once again that any effect of copper cannot be judged by vegetative growth but that grain yields are necessary if any benefit is to be determined.

The following results were obtained—

	bush.	lb.	% of control.
Treatment A—Superphosphate	17	16	100
B—Superphosphate, plus Cu ..	20	42	120
C—Superphosphate, plus Zn ..	20	42	120
D—Superphosphate, plus Cu, Zn ..	31	4	180
E—Superphosphate, plus Cu, Zn, Mn, Mg, B, Mo	28	30	165
F—Superphosphate, plus Cu, Zn, Mn, Mg, B, Mo, K	31	56	185
G—No superphosphate, Cu, Zn, Mn, Mg, B, Mo, K	26	36	154

Difference for significance at 5% level = 1 bush. 22 lb.
Difference for significance at 1% level = 1 bush. 51 lb.

DISCUSSION OF RESULTS.

It will be seen that while copper and zinc when used with superphosphate each gave statistically significant increased yields (increase 3 bush. 26 lb./ac.) over the control, a much more striking increase (13 bush. 48 lb.) was obtained when both were used in combination. Observations suggest that the beneficial effect of zinc was due to increased vegetative growth whereas copper is needed to ensure the formation of grain. Their use together therefore gave a vastly improved yield.

It should be noted that the zinc content (approximate total 250 ppm. water soluble 160 ppm.) of the superphosphate made from African rock and used in this experiment was considerably below that of the prewar superphosphate (approximate zinc content—total 500 ppm., water soluble 450 ppm.) made from Nauru Island rock. However, it must be remembered that the response reported by Teakle was obtained in an experiment conducted in 1941 when Nauru Island was the source of phosphatic material. Benefit was therefore obtained from the use of zinc on this soil type irrespective of the zinc content of the phosphatic rock used for the manufacture of superphosphate.

It is difficult to determine the effect of potash on crop yield, because of the initial retardation of growth, attributed to other mineral elements, of the plots to which this fertiliser was applied. The lowest figure for potash content of top

leaves in September (superphosphate, copper, zinc plot—potassium 1.65%) indicated a reasonable supply of this element but a definite conclusion must await further field trials.

As the comparisons for determining the value of superphosphate could only be made between plots also retarded in the early growth stages by other included compounds (treatments F and G), no conclusion based on growth or yield could be reached. For various reasons, it is considered that further field trials should be conducted.

At the present stage, the only definite conclusion warranted is that copper and zinc supplies of the soil investigated are insufficient for wheat crops and that the use, with superphosphate, of certain compounds containing these elements can give considerably increased yields. At present prices, the cost of the copper sulphate used was about 6s. 3d. per acre and of the zinc sulphate 1s. 3d. per acre making a total additional cost of about 7/6 per acre. In view of the increased yield obtained, the use of these compounds is definitely warranted for wheat production.

In other areas within the State, it has been found possible to replace copper sulphate (bluestone) by oxidised copper ore which is a cheaper source of copper. Furthermore, experiments with flax have indicated the zinc sulphate can be replaced, as a source of zinc, by the cheaper zinc oxide. However, these substitutions have been made, for the most part, on slightly acid soils. Whether the cheaper but less soluble sources of copper and zinc will be effective on the alkaline Dongara soils under consideration remains to be determined. In this connection, Teakle (1942) suggested that, under such alkaline conditions, the availability of copper and zinc, even when added as the soluble copper and zinc sulphates, might be low and better results might be obtained from the use of increased quantities.

Further experiments are therefore necessary with this soil type to determine whether greater quantities of zinc and copper can be used to advantage, whether zinc sulphate and copper sulphate can be replaced by cheaper sources of these elements such as by zinc oxide dust and by oxidised copper ore, whether the use of potash in addition is profitable, and whether superphosphate can be used in lesser quantities. It is hoped that some or all of these items can be investigated during the coming season.

SUMMARY.

An account is given of a fertiliser trial with wheat wherein a number of mineral elements were used in various combinations with superphosphate.

The yields showed statistically significant responses when copper and zinc were used individually with superphosphate. A more striking increase in yield was obtained when zinc and copper were used together with superphosphate.

Due to an inhibiting effect on early growth, presumably due to other compounds with which it was used, it was not possible to determine whether the addition or potash fertiliser has an effect on yield.

For the same reason a definite conclusion concerning the necessity of superphosphate for maximum yields has not been possible.

ACKNOWLEDGMENT.

Grateful acknowledgment is made of the assistance of Mr. J. M. Steele on whose property the experiment was conducted and by whom the necessary operations were so accurately performed.

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Teakle, L. J. H.: Experiments with Micro-elements for the Growth of Crops in Western Australia. *Jnl. Agric. West Australia,* 19:242-253.

VETCH SEED AS STOCK FOOD.

A further Note concerning the possible presence of poisonous substances.

L. C. Snook, Animal Nutrition Officer.

In the December, 1947, issue of this Journal the composition and food value of locally grown leguminous seeds was discussed. Attention was drawn to the possibility that selected strains of the common vetch may prove a very valuable source of protein-rich seed. This seed could be fed off by sheep in the manner now practised with field peas or lupins, or the crop could be harvested so that the seed could be fed to dairy cattle or poultry.

The warning was given, however, that some strains of vetch have seeds which may at times prove poisonous. Tests are therefore being carried out to make sure that none of the varieties which have shown such promise under our Wheat Belt conditions, are in any way dangerous to stock.

A bulk sample of vetch seed (*V. sativa,* Hawkesbury strain) grown at Wongan Hills Research Station in 1947 was forwarded to the Animal Health Laboratory at Nedlands for thorough testing. The results indicate that the seeds of this vetch are harmless.

Chemical tests indicated that the seed grown at Wongan Hills contained only a trace of the cyanogenetic glucocides which may sometimes render vetch seed poisonous. Analyses carried out by the Government Chemical Laboratories showed that less than 0.01 per cent. hydrocyanic acid (HCN) could be distilled from the seeds. This is an insignificant amount and feeding tests seemed a waste of valuable seed.

However, to make certain that no other dangerous substances were present, vetch seed was fed ad lib to hungry sheep and fowls.

A wether placed in a concrete pen did not at first eat the vetch seed readily but when mixed with a little bran, ten pounds of seed were consumed in ten days. No symptoms of ill-health were observed, the wether looking well when released.

Two cockerels were starved for two days and then offered crushed vetch seed. This was not eaten readily unless mixed with damp pollard. In a week the birds ate 10 oz. of the vetch seed. No ill effects were observed.

There seems every reason to hope that the strain of common vetch now being developed at the Wongan Hills Research Station is relatively free from the dangerous cyanogenetic glucocides which have been reported in some varieties. A strain (W156) selected for seed yield at Muresk, in contrast, was found to contain 0.03 per cent. of hydrocyanic acid in the dry matter. Even at this level the seeds are hardly likely to prove in any way dangerous but obviously it is wise to develop the strains which contain least cyanide. It seems that the Hawkesbury strain is a particularly safe one.

In the December Journal it was shown that the various leguminous seeds are very uniform in composition, from year to year and when grown under a variety of conditions. It is therefore interesting to note that the vetch seeds grown at Wongan Hills in 1947 were very similar in composition to those grown in 1946. In both years less than 0.01 per cent. hydrocyanic acid could be detected in the seeds.

NEW ZEALAND BLUE LUPINS.

COMMENTS ON THEIR VALUE AS STOCK FOOD.

L. C. SNOOK, Animal Nutrition Officer.

IN the December, 1947, issue of this Journal, in an article on the food value of leguminous seeds, the author was rather cautious in recommending the growth of New Zealand Blue Lupins as a source of food for sheep.

A number of farmers has since written to the Department describing the excellent results obtained where this legume has been grown for sheep feed. It was very pleasing to receive this enthusiastic evidence that the New Zealand Blue Lupin has proved so successful in the wetter portions of the State.

With the writer's permission I would like to quote a few of the remarks received in letters, because these will be of great value and interest to other farmers.

Mr. G. V. Mitchell of Bickley Park, Donnybrook, has been growing New Zealand Blue Lupins for six (6) years. At first the sheep had to be taught to eat the seeds but now the trouble is to keep sheep out of the lupin paddocks. Mr. Mitchell has found lupins an excellent crop with which to smother bracken. The fern was rolled with a heavy angle-iron roller, burnt at the end of summer, and sown during April and May with oats and lupins. The rate of seeding was:—Oats 60 lb., lupins 30-45 lb., superphosphate 200 lb. per acre. The field was stocked until the lupins were nearly in flower and then shut up. The lupins then completely smothered the bracken fern, producing an enormous crop of seed for the sheep during the summer. The wool returns have greatly improved since lupins have been grown.

A farmer of Mundijong is another who has found New Zealand Blue Lupins a great success. His only complaint is that the plants are "too palatable." In his experience, sheep will eat out the growing lupins if given the opportunity. The dried plant material seems equally palatable, only very thick stalk stubs being left unconsumed. On this property the lupins grew to a height of five feet and were so thick as to prevent anyone walking through. No evidence of any toxic symptoms have ever been observed in sheep eating these lupins. In New Zealand lupins are grown extensively as green feed but it seems that this strain needs some protection while it is growing.

It is very apparent that the New Zealand Blue Lupin may be used to great advantage by sheep farmers, as well as orchardists. The seed is much cheaper than the local strain and this should encourage its greater use in the wetter areas where the West Australian Blue Lupin does not thrive. It has possibilities also as an annual fodder crop in place of field peas.

There seems to be no doubt about the plants or the seed being palatable. The fact that the green plant is so palatable may in fact be a disadvantage, but in some cases at least it seems that stock can be admitted during the early part of the growing season. It is also apparent that if the New Zealand Blue Lupin contains any toxic principal, the effect is so insignificant as to be quite out-weighed by the many advantages.

BULLDOZERS FOR WATER CONSERVATION.

By C. W. TOBIN, Dairy Instructor.

THE first demonstration of bulldozer clearing was carried out on Mr. W. Frost's property, Kendenup in January, 1945. In 1947, another important use of the bulldozer was demonstrated on the same property.

Fig. I.
Bulldozer pushing up earth for dam wall.

Fig. II.
Removing material from floor of dam.

Fig. III.
Making the wall.

An earth wall was built across the creek thereby damming a large quantity of water. This is no ordinary dam such as one would expect to see on a farm, but has the capacity to supply a small town with its water requirements for several months.

Practically all farmers at some time or other are faced with a dry season when insufficient water for stock and crops has a disastrous effect on production. Even in the beautiful Kendenup country it is quite obvious that greater water conservation for summer usage would increase production, and it was this fact that prompted Mr. Frost to do something about it. It was not until bulldozers became available on a hire basis to farmers that an ordinary farmer could undertake the financing of a proposition of this size, so this is a very practical demonstration of the part bulldozers are playing, and can play in increasing agricultural production.

Fig. IV.
Levelling the top of the wall.

The machine used was a D7 caterpillar owned by Mr. Hawker of Kendenup. It was worked under Mr. Frost's supervision, building the wall to his specifications. There are still a few details to be completed before the dam is properly finished, however, the main objective, i.e. the holding of a large quantity of water, has been accomplished, and great credit is due to Mr. Frost on his achievement.

Details of the dam are as follows:

The wall is built of earth and clay swept into position with the bulldozer. It is 110 feet through at the base sloping to 10 or 12 feet at the top, and the height 21 feet at the centre. The length of the wall is 140 yards. A six inch pipe and sluice valve is fitted in the bottom of the wall to allow the dam to be emptied when desired. There is, of course, a large spillway at the side to allow flood waters to get away.

Fig. V.
Section of the 420 ft. x 21 ft. wall from the down stream side.
Photo: C. W. Tobin.

Fig. VI.
Looking down stream towards wall 400 yards away.
Photo: C. W. Tobin.

Fig. VII.

Looking up stream from the wall. Approximately 560 yards to furthermost point. Mr. Frost standing at water's edge right.

Photo: C. W. Tobin.

The approximate amount of earth in the wall is 7,000 cubic yards, and this was put into position and packed down by the bulldozer in 110 hours working time.

The measurements when full are approximately: 560 yards long, 140 yards wide, and 18 feet deep at the wall. Depth and width gradually recedes from the wall. Its estimated capacity is over 11,000,000 gallons.

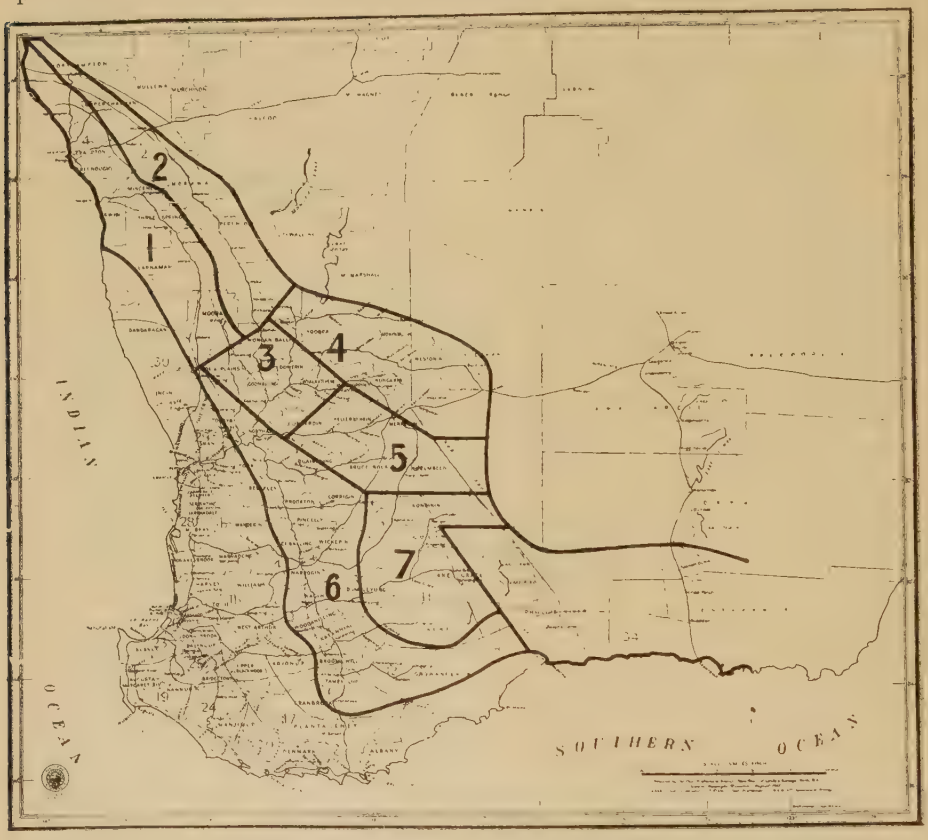
It is yet too soon to say all the uses this water will be put to but some is to be used for irrigating 15 acres of orchard and then probably an area of lucerne will be grown and irrigated.

W.A. FLOUR MILLOWNERS' ASSOCIATION 50 ACRE WHEAT CROP COMPETITION.

I. Thomas, Superintendent of Wheat Farming.

During 1946 a 50-acre crop competition was sponsored by the Western Australian Flour Millowners' Association and conducted under the auspices of the Royal Agricultural Society and judged by officers of the Department of Agriculture. The whole of the substantial prize money amounting to £495, was donated by the Association.

Crop competitions have been conducted under the auspices of the Royal Society for many years and were a feature of pre-war wheatbelt farming. For the purpose of judging, the wheatbelt was divided in the early years into eight zones, having regard to climatic, seasonal and other conditions. Since 1940, however, Zones 6 and 8 have been amalgamated into one zone, viz. Zone 6. The present seven zones are as shown on the accompanying map.



For the present competition the same zones are used, but the main difference is that with it points are awarded for the baking quality of the flour produced from the wheat obtained from the competing crop. The inclusion of points for baking quality in a wheat crop competition is unique in Australia and possibly elsewhere. The object prompting the W.A. Flour Millowners' Association to provide for this condition was to encourage the production of high yielding varieties of wheat which were also capable of producing good quality flour.

The conditions regarding the awarding of points for baking quality included the provision that no prize was to be awarded to any crop which returned a strength figure of less than 5 minutes as measured on the farinograph. The farinograph is an instrument used in the laboratory for the determination of the baking quality (strength figures) of flours. It was further decided that maximum points for strength would be awarded to all crops which returned a strength figure of 10 or more minutes. This condition was made so that the points awarded for baking quality would not outweigh those for yield. Because of this no advantage could be gained by a competitor entering a crop of a variety having a specially high baking quality. The conditions and details of the competition are as follows:—

Conditions.

(1) The area of each competing crop must be not less than 50 acres of any one of the following standard varieties:—

Bencubbin, Bungulla, Charter, Eureka, Ford, Koorda, Kondut, Merredin, Nabawa, Sutton.

(2) Each competitor will be limited to one entry.

(3) The competition will be judged on the following scale of points:—

a. Yield per acre	50 points
b. Freedom from admixture	10 points
c. Freedom from disease	10 points
d. Baking quality of flour	30 points
Total ..	100 points

(4) The competition crop must be a compact and unbroken block of not less than 50 acres with straight sides, except on natural boundaries and must be clearly defined before the arrival of the judge by either binder tracks cut or corner pegs showing prominently above the crop. Only the standing crop, the grain of which is recoverable by recognised harvesting practice, is to be taken into consideration.

(5) The competitor must arrange for the judge to be met on arrival of train, conveyed to the plot of wheat, and following inspection, the competitor must convey the judge to the next nearest competitor in his district.

(6) The judge's report will be available for publication.

(7) One bag of wheat from each prize winning crop must be exhibited at the succeeding Royal Show with a card attached showing the points allotted to it.

(8) The entry fee for each crop shall be 5/-. Where District competitions are held, *under similar conditions to this competition,* only the first and second prize winners in such competitions will be eligible to compete. Secretaries of Agricultural Societies conducting such District Competitions must, on or before the 15th September, 1947, forward to the Secretary of the Royal Agricultural Society the entry fee of 10/- to cover the first and second prize winners in their District Competition and later when the names of these place getters are known, forward the names and addresses of these competitors to the Royal Agricultural Society.

(9) All entries must be lodged with the Royal Agricultural Society not later than 15th September.

(10) Prizes are offered as under:—

In each zone, First £40, Second £15. Zone winners will be eligible for State Championship prizes of First £60, Second £30, Third £20.

(11) No prize will be awarded to any variety should the strength figure of its flour be below five minutes as determined on the farinograph, or to any crop awarded less than a total of 60 points.

It will be noted that, as with previous competitions, provision is made for State Championship awards as well as Zone championships.

1946-47 SEASON COMPETITION.

As stated earlier this competition was first conducted during 1946, and in that year a total of 40 entries, inclusive of the first and second prize winners in the local competition conducted by the Merredin district Agricultural Society, was received.

The number of areas actually inspected in order to determine those crops eligible for inclusion in the competition, was 37, but of these only 32 qualified to be considered for the State championship. One crop inspected failed to qualify due to too low baking quality.

The winners of the State Championship awards are as follows:—

1st. J. L. Hughes, Wongoondy, Zone 2 .. .. .. 87 points
2nd. B. M. Caterer, Gnowangerup, Zone 6 .. .. .. 84 points
3rd. E. A. Metcalf, Wyalkatchem, Zone 3 .. .. .. 80 points

All of these crops were of the early maturing variety, Bungulla.

Details of the 1946 State Championship and Zone awards are given in the following tables.

STATE CHAMPSHIP IONAWARDS.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Hughes, J. L.	Wongoondy via Mullewa	Bungulla	40	8	9	30	87
Caterer, B. M.	Gnowangerup	Bungulla	39	8	8	29	84
Metcalf, E. A.	Wyalkatchem	Bungulla	33	9	9	29	80
Cuming, J. J. and Sons	Korbel via Merredin	Bungulla	33	9	9	28	79
Hebberman, H.	Emu Hill	Bencubbin	33	8	8	29	78
Watkins, A. H.	Karloning via Mukinbudin	Bungulla	28	9	9	30	76
O'Leary, K. J. and C. J.	Walgoolan	Bungulla	29	8	8	30	75
McQuat, W. G.	Miling	Bencubbin	29	8	9	28	74
Hebiton, G. B.	Mendel via Mullewa	Bungulla	28	9	8	29	74
Walton, C. B.	Hyden	Bungulla	29	8	9	28	74
Smart, E. F.	Wongan Hills	Bungulla	28	8	8	29	73
Lynch, T. A.	Hyden	Bungulla	27	8	8	29	72
Hyde, N. F.	Waddy Forest via Coorow	Koorda	24	9	8	30	71

Zone 1.

Field Judge—G. L. Throssell, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
McQuat W. G.	Miling	Bencubbin	29	8	9	28	74
Hyde, N. F.	Waddy Forest via Coorow	Koorda	24	9	8	30	71

Zone 2.

Field Judge—G. L. Throssell, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Hughes, J. L.	Wongoondy via Mullewa	Bungulla	40	8	9	30	87
Hebiton, G. B.	Mendel via Mullewa	Bungulla	28	9	8	29	74
Heitman, E. G.	Morawa	Bungulla	22	9	9	29	69

Zone 3.

Field Judge—E. R. Watson, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Metcalf, E. A.	Wyalkatchem	Bungulla	33	9	9	29	80
Smart, E. F.	Wongan Hills	Bungulla	28	8	8	29	73
Knapp, J. and Sons	Ballidu	Bencubbin	27	7	9	27	70
Fordham, N. A.	Calcarra	Bencubbin	21	9	9	26	65
Munyard, A. E.....	Minnivale	Kondut	20	7	9	27	63

Zone 4.

Field Judge—E. R. Watson, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Watkins, A. H.....	Karloning via Mukinbudin	Bungulla	28	9	9	30	76
O'Leary, K. J. and C. J.	Walgoolan	Bungulla	29	8	8	30	75
Howard, J. H.	Gabbin	Bencubbin	26	9	9	30	74
Perry Bros.	Bencubbin	Bungulla	26	9	9	30	74
Bent, G.	Karloning via Mukinbudin	Bungulla	25	9	9	29	72
Irvine, C. L.	Karloning via Mukinbudin	Bungulla	23	8	9	30	70
Stiepwich, W. N.	Karloning via Mukinbudin	Bungulla	18	9	9	29	65
Manuel, C. J.	Mukinbudin	Bungulla	18	8	9	30	65

Zone 5.

Field Judge—A. J. T. Marshall, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Cuming, J. J. and Sons	Korbel	Bungulla	33	9	9	28	79
Hebberman, H.	Emu Hill	Bencubbin	33	8	8	29	78
Teasdale, W. H. and Sons	Merredin	Bencubbin	30	8	9	29	76
Kay, John	Baandee	Bungulla	24	8	9	29	70
York, H. S.	Tammin	Bungulla	21	8	8	27	64
Growden Bros.	Nangeenan	Bungulla	18	8	9	29	64

Zone 6.

Field Judge—A. J. T. Marshall, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Caterer, B. M.	Gnowangerup	Bungulla	39	8	8	29	84
*King, W. H.	Toodyay	Bencubbin	27	8	9	....	....

*Did not qualify for an award due to too low Baking Strength.

ZONE 7.

Field Judge—H. G. Cariss, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Walton, C. B.	Hyden	Bungulla	29	8	9	28	74
Lynch, T. A.	Hyden	Bungulla	27	8	8	29	72
Hall, W. G.	Hyden	Bencubbin	28	7	8	28	71
Walton, T.	Hyden	Bencubbin	27	9	8	26	70
Lynch, P. J.	Hyden	Bungulla	27	8	8	26	69
Clayton, R. G.	Hyden	Bencubbin	23	9	8	28	68
Ray, H. A.	Karlgarin	Bungulla	24	8	8	28	68

It will be noted from the above results that some excellent calculated yields were recorded ranging from 18-40 bushels per acre. Five of the competitors obtained a yield of 30 bushels or more per acre and the average for all competitors was a little over 26 bushels per acre. Having regard to the lack of beneficial finishing rains, following upon excessive recordings during the early part of the growing season, the yields obtained must be considered very satisfactory. It is of interest to note that the winning crop for six of the seven zones was of the very early maturing Bungulla, the winning variety in the other zone being Bencubbin.

1947-48 SEASON COMPETITION.

For the 1947 Competition there was a considerable increase in the number of entries, though not as large as anticipated due to the adverse seasonal conditions during August and September. Due to the seasonal conditions also, a number of the entries were withdrawn prior to being inspected. The total number of entries received was 63, inclusive of the first and second prize winners in five local district Agricultural Society competitions.

In order to determine those eligible for inclusion in the competition, including the first and second prize winners in the local competitions, it was necessary to inspect a total of 45 crops. Of these 45, 39 were eligible for consideration in the final judging.

Details of the State Championship awards are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
ZONE 6— Moir, G. R.	Borden	Kondut	44	9	9	26	88
ZONE 1— Bothe, B. D.	Coorow	Bungulla	42	9	9	27	87
ZONE 6— Caterer, B. M.	Gnowangerup	Bencubbin	39	9	9	28	85
ZONE 2— Heitman, E. G.	Morawa	Kondut	40	8	9	27	84
ZONE 1— Morrell Bros.	Narra Tarra	Eureka	40	8	7	28	83
ZONE 2— Chappel, E. J. L.	Bowgada	Bungulla	34	9	9	29	81
ZONE 3— Alexander, D....	Goomalling....	Bencubbin	34	8	9	26	77
ZONE 5— Latham, A. W.	Narembeen....	Bencubbin	29	9	9	27	74
ZONE 3— Watson, R. G.	Wyalkatchem	Bungulla	31	8	9	26	74
ZONE 5— Cuming, J. J.	Korbel	Bencubbin	26	9	9	27	71
ZONE 7— Hudson, G	Newdegate	Ford	22	9	9	28	68
ZONE 4— Gobbard & Son	Gabbin	Bungulla	21	9	9	28	67
ZONE 4— Collins, H. J.	Bencubbin	Bungulla	20	9	8	29	66

The yields obtained from all of the above crops must be considered highly meritorious under the rather difficult seasonal conditions experienced in all zones during August and September. Details of the first and second prize winners in the individual zones are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength	Total	Place.
ZONE 1—								
Bothe, B. D.	Coorow	Bungulla	42	9	9	27	87	2
Morrell Bros.	Narra Tarra	Eureka	40	8	7	28	83	5
ZONE 2—								
Heitman, E. G.	Morowa	Kondut	40	8	9	27	84	4
Chappel, E. J. L.	Bowgada	Bungulla	34	9	9	29	81	6
ZONE 3—								
Alexander, D.	Goomalling	Bencubbin	34	8	9	26	77	7
Watson, R. G.	Wyalkatchem	Bungulla	31	8	9	26	74	9
ZONE 4—								
Gobbard and Son	Gabbin	Bungulla	21	9	9	28	67	12
Collins, H. J.	Bencubbin	Bungulla	20	9	8	29	66	13
ZONE 5.—								
Latham, A. W.	Narembeen	Bencubbin	29	9	9	27	74	8
Cuming, J. J.	Korbel	Bencubbin	26	9	9	27	71	10
ZONE 6.—								
Moir, G. R.	Borden	Kondut	44	9	9	26	88	1
Caterer, B. M.	Gnowangerup	Bencubbin	39	9	9	28	85	3
ZONE 7.—								
Hudson, G.	Newdegate	Ford	22	9	9	28	68	11
*Marshall, H. J.	Hyden	Bencubbin	21	9	9	....	....	....

*Did not qualify for an award due to too low Baking Strength.

With all the zones some of the calculated yields were quite outstanding, the range of all entries being from 15-44 bushels per acre. Twenty-four of the crops recorded yields of 30 bushels or more per acre and of these 5 yielded 40 bushels or more. The average for all competing crops was a little more than 29 bushels per acre.

These results must be considered highly satisfactory for although the early growth period was very favourable, the August and September conditions were most unseasonable, much below normal rainfall being recorded, with in addition, some excessively severe frosts being experienced. Also, though most districts received late finishing rains, there were a few cases where they were too late to permit of crops benefiting fully.

Full details of the awards in the different zones and the judges' reports are as follows:—

ZONE I.

Field Judge: G. L. THROSSELL, Agricultural Adviser.

In this zone there were 13 entries, including the first and second prize winners in the local competition conducted by the Three Springs District Agricultural Society. Six of the entries were, however, withdrawn prior to inspection.

Points were awarded as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Bothe, B. D.	Coorow	Bungulla	42	9	9	27	87
Morrell, Bros.	Narra Tarra	Eureka	40	8	7	28	83
Tunbridge, A. H.	Arrino	Bencubbin	40	8	8	26	82
Smart & Tremett	Mingenew	Bungulla	37	8	7	28	80
Haeusler, R. C.	Three Springs	Bencubbin	35	8	8	27	78
Morcombe, W. G. & Sons	Coorow	Bungulla	34	8	7	27	76
Chappel, H. H.	Winchester....	Bungulla	33	8	8	26	75

The winning crop was grown by Mr. B. D. Bothe of Coorow, which, calculated to yield 42 bushels per acre, was very uniform but had lodged badly. This entry, in addition to being awarded first prize in the zone, was placed second in the State Championship. The crop, of the variety Bungulla, was planted during the last week in May at the rate of 60 lb. of seed with 180 lb. of super per acre. It was part of 120 acres of the same variety sown on land originally carrying Salmon Gum timber. For some time this land had been under a four year rotation of fallow—wheat—stubble—pasture.

Second place was gained by Messrs. Morrell Bros. of Narra Tarra with the midseason rust resistant variety Eureka. This crop calculated to yield 40 bushels per acre, was sown at the rate of 60 lb. of seed and 90 lb. of super per acre at the end of May on land which had originally carried York Gum and Jam timber. For the previous ten years the paddock had been down to pasture which included a sprinkling of volunteer subterranean clover introduced by sheep and had been topdressed annually.

Another creditable performance was that of the crop of Bencubbin grown by Mr. A. H. Tunbridge of Arrino, which was calculated to return a yield similar to that of Messrs. Morrell Bros., but the baking quality of the grain was lower.

The rainfall data for 1947 at the centres concerned are tabulated hereunder.

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Coorow	122	....	65	74	285	298	284	89	95	301	1,352	10	....	1,623
Narra Tarra	*	*	*	*	436	466	517	190	233	616	2,458	*	*	....
Three Springs	28	69	35	116	340	252	286	117	130	298	1,423	10	....	1,681
Mingenew	....	12	64	75	348	260	331	115	179	399	1,632	20	....	1,803
Carnamah	....	141	90	151	318	275	263	103	142	218	1,319	10	....	1,711

* Not Available.

The season generally was a very good one, there being very satisfactory opening rains which were well sustained throughout the winter. Recordings for August were below average and some anxiety was felt. However, late rains in October gave a very good finish to the season, particularly to the heavy yielding crops, though they did tend to cause some lodging, some crops being seriously affected under such conditions.

The competing areas were all of a very high standard. The average calculated yield for all competitors was a little above 37 bushels per acre, ranging from 33 to 42 bushels per acre.

Cultural details for the competing areas are as follows:

Competitor	Bothe, B. D.	Tunbridge, A.H.	Morrell Bros.	Smart & Tremlett.
Years cropped	Old land	Old land	Old land	Old land
Original timber	Salmon Gum	Salmon Gum, York Gum	York Gum, Jam	York Gum, Curara
Ploughed	Late July	August	Middle May, 1947	Early August
Condition of land	Good	Good	Getting hard	Wet
Implement	Disc plough	Rigid tyne scarifier	Disc cultivator	Twin disc
Depth	4 in.	4 in.	3½ in.	4 in.
Subsequent .... Cultivations	Scarified August Combined April	Scarified prior to seeding	....	Combined prior to seeding
Variety	Bungulla	Bencubbin	Eureka	Bungulla
Planted	End of May	End of May	End of May	Mid May
Rate of seed	60 lbs.	50 lbs.	60 lbs.	60 lbs.
Rate of super.	180 lbs.	75 lbs.	90 lbs.	112 lbs.
Graded	Yes	Yes	No	Yes
Treatment	Ceresan	Copper carbonate	Nil	Copper carbonate
Type of drill	Combine	Combine	Sunder seeder	Combine
Disease	....	Trace Rust and Septoria	Take-all	Take-all

Competitor	Haeusler, R. C.	Morcombe, W. G. & Sons.	Chappel, H. H.
Years cropped	Old land	Old land	Old land
Original timber	Salmon Gum, York Gum and Jam	Salmon Gum, Gimlet	Salmon Gum, Gimlet
Ploughed	March, 47.	July	May
Condition of land	Good	Wet	Good
Implement	Rigid tyne scarifier	Rigid tyne scarifier	Rigid tyne scarifier
Depth	3 in.	3 in.	3 in.
Subsequent Cultivations		Cross ploughed with disc cultivating plough in September, scarified at end of April	Combined September, October, April. Combined first week of June, reseeded
Variety	Bencubbin	Bungulla	Bungulla
Planted	Early May	3rd week May	Last week June
Rate of seed	61 lbs.	60 lbs.	55 lbs.
Rate of super.	110 lbs.	112 lbs.	110 lbs.
Graded	Yes	Yes	Yes
Treatment	Copper carbonate	Copper carbonate	Copper carbonate
Type of drill	Combine	Combine	Combine
Disease	Trace Take all and Rust	Take-all	Trace Rust

ZONE II.

Field Judge—G. L. Throssell, Agricultural Adviser.

There were 13 entries in this zone but 4 were withdrawn prior to inspection. Points were awarded as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Heitman, E. G.	Morawa	Kondut	40	8	9	27	84
Chappel, E. J. L.	Bowgada	Bungulla	34	9	9	29	81
Hyde, N. F.	Waddy Forest	Koorda	36	9	9	26	80
Collins, H.	Wubin	Bungulla	35	9	9	27	80
Bradford, R.	Damboring	Kondut	34	7	8	30	79
McGregor, G. & Son	Menang	Bungulla	31	9	9	28	77
Hebiton, D. S.	Mendel	Koorda	34	9	7	26	76
Harrington, S. C.	Damboring	Bencubbin	30	7	7	26	70
McAuliffe, F.	Mendel	Bungulla	30	8	9	....	....

The winning crop was that submitted by Mr. E. G. Heitman of Morawa. This crop, part of 70 acres of the late midseason variety Kondut, was calculated to yield 40 bushels per acre. It had been sown during the second week in May at the rate of 45 lb. of seed and 90 lb. of super per acre. The crop was standing very well at a good stripping height but some slight admixture of another variety due to wash from a neighbouring paddock, was present. The land on which the crop was sown had originally carried Salmon Gum and Morrel timber and had been cleared about 40 years. Of recent years it had been cropped in a two year rotation.

The entry made by Mr. E. J. L. Chappel of Bowgada gained second place and though calculated to yield two bushels per acre less than the competing area of Mr. N. F. Hyde of Waddy Forest, displaced that competitor from second place on account of superior baking quality.

Mr. Chappel's competing area, of the variety Bungulla, was sown at the rate of 55 lb. of seed and 75 lb. of super per acre during the second week in May on former Salmon Gum and Gimlet country which had been under cultivation for many years.

The competitors in this zone returned satisfactory yields and all crops were calculated to yield 30 or more bushels per acre. The calculated average yield for the zone was a little more than 33 bushels per acre.

The rainfall data at the centres concerned for 1947 is as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Morawa	39	17	92	101	217	168	250	66	110	249	1,060	8	3	1,320
Perenjori	40	62	254	52	271	171	290	47	88	212	1,079	....	....	1,487
Wubin	6	....	161	29	204	174	199	79	101	146	903	14	....	1,113
Waddy Forest	0	16	59	70	308	236	256	116	105	212	1,233	30	....	1,408
Ballidu	119	24	150	128	227	222	209	58	103	173	992	2	10	1,425
Mullewa	....	146	107	87	296	138	262	71	98	216	1 081	2	3	1,426

The season generally in this zone was very satisfactory. Excellent germination and early winter rains were experienced but adverse conditions were experienced during August and September and it appeared for a time that the season would finish very badly. With late spring rains, however, the crops made excellent recovery and satisfactory yields were obtained.

Cultural details for the competing areas are as follows:—

Competitor	Heitman, E. G.	Hyde, N. F.	Collins, H.	Chappel, E. J. L.	Hebiton, D. S.
Years cropped....	Old land	Old land	Old land	Old land	Old land
Timber	Salmon Gum, Morrel	Salmon Gum	Salmon Gum	Salmon Gum. Gimlet	Salmon Gum
Ploughed	June—July	August	July	July	End of September
Condition of land	Good	Good	Good	Good	Very hard
Implement	Disc	Disc	Scarifier	Disc	Disc
Depth	4in.	4in.	4—5in.	3in.	2in.
Subsequent Cultivation	Harrowed November and again February Rigid type cultivator in mid-April	Combined September, disc cultivated in February	Combined the first week in April	Disc cultivated September, scarified end of April	Disc ploughed in March
Planted	2nd week in May	3rd week in May	Mid-May	2nd week in May	Mid-May
Rate of seed	45lbs.	60lbs.	43lbs.	55lbs.	50lbs.
Rate of super	90lbs.	90lbs.	103lbs.	75lbs.	90lbs.
Graded	Yes	Yes	Yes	Yes	Yes
Seed treatment	Copper Carb.	Copper Carb.	Ceresan	Copper Carb.	Copper Carb.
Type of drill	Rigid tyne combine	Combine	Combine	Combine	Sunder seeder
Disease	....	....	Trace of Take-all	....	Take-all and Rust
Variety	Kondut	Koorda	Bungulla	Bungulla	Koorda

Competitor	McGregor, G. and Son	Bradford, R.	McAuliffe, F.	Harrington, S. C.
Years cropped....	Old land	Old land	Old land	Old land
Timber	Salmon Gum, York Gum	Salmon Gum, Gimlet	Salmon Gum	Salmon Gum, Gimlet, York Gum
Ploughed	July—August	End of July	August—July	July
Condition of land	Good	Good	Good	Good
Implement	Disc cultivating	Disc	Disc	Disc cultivating
Depth	3in.	4—5in.	3—4in.	3½in.
Subsequent Cultivation	....	Combined end of August, March and prior to seeding	....	Spring tyne cultivated in October and prior to seeding
Planted....	2nd week in May	Mid-May	Early May	1st week in May
Rate of seed	60lbs.	45lbs.	60lbs.	50lbs.
Rate of super.....	75lbs.	90lbs.	80lbs.	120lbs.
Graded	Yes	Yes	Yes	Yes
Seed treatment....	Copper Carb.	Copper Carb.	Copper Carb.	Copper Carb.
Type of drill	Combine	Combine	Combine	Combine
Disease	....	Trace of Flag Smut and Take-all	....	Take-all
Variety	Bungulla	Kondut	Bungulla	Bencubbin

ZONE III.

Field Judge—E. R. WATSON, Agricultural Adviser.

Thirteen entries were received for this zone but six of these were withdrawn prior to inspection. Awards were made as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Alexander, D.	Goomalling....	Bencubbin	34	8	9	26	77
Watson, R. G.	Wyalkatchem	Bungulla	31	8	9	26	74
Martin, F.	Cadoux	Bungulla	30	7	8	27	72
Knapp, J. & Son....	Ballidu	Bencubbin	28	8	8	27	71
Metcalf, E. G.	Wyalkatchem	Bungulla	25	9	9	27	70
Lines, W. H.	Ballidu	Bungulla	22	8	7	26	63
Goodie, H.	Ballidu	Bungulla	17	7	9	27	60

The winning entry was that of the crop of the standard midseason variety Bencubbin grown by Mr. D. Alexander on the property of Slater & Co., Goomalling. This crop being part of 135 acres of the same variety, gave a satisfactory calculated yield of 34 bushels per acre and was an exceptionally well grown heavy crop. Despite its height, it stood very well, but showed a few odd heads of another variety. Rate of sowing was 53 lb. of seed with 90 lb. super per acre.

The land had originally carried Salmon Gum and Gimlet timber and had been cleared about 40 years. Of recent years it had been cropped on a three year rotation.

Mr. R. G. Watson of Wyalkatchem, submitted the entry of a crop of the variety Bungulla which gained second place. This crop was calculated to yield 31 bushels per acre. For the most part it was well grown, but it had lodged and was considerably tangled in places. In addition some admixture of a club-headed variety was present. The crop had been sown at the rate of 60 lb. of seed and 110 lb. of super per acre during the last week in May.

Details regarding the rainfall during 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Goomalling	7	....	88	165	346	270	196	49	59	147	1,067	59	5	1,382
Wyalkatchem	28	75	62	128	207	206	200	29	46	254	942	3	54	1,292
Cadoux	4	20	83	107	263	248	240	85	70	150	1,056	87	2	1,359
Ballidu	119	24	150	128	227	222	209	58	103	173	992	2	10	1,425

In common with other parts of the wheatbelt, the growing conditions during late Autumn and early Winter were most favourable, but during August and September beneficial rains were lacking and the prevalence of heavy frosts caused considerable anxiety. However, excellent rains were experienced in October which resulted in satisfactory yields being obtained. The averaged calculated yield of the competing areas was a little over 26 bushels per acre.

Cultural details of the different competing areas are set out for comparison as follows:—

Competitor	Alexander, D.	Watson, R. G.	Martin, F.	J. Knapp & Son.
Years cropped	40 years	20 years	....	25–30 years
Timber	Salmon Gum, Gimlet	Salmon Gum, Gimlet	Salmon Gum, Gimlet	Salmon Gum, Gimlet
Ploughed	June	July	Mid July	Early August
Type of plough	Disc	Disc cultivating	Disc cultivating	Disc cultivating
Depth	4 in.	4 in.	4 in.	4 in.
Other cultivations	Cultivated end of April	Ploughed back in October with same implement and again in April	Ploughed back in September and again in May with same implement	Cultivated in September with spring tyne combine
Variety	Bencubbin	Bungulla	Bungulla	Bencubbin
Planted	17th May	28th May	26th May	1st week in May
Rate of seed	53 lbs.	60 lbs.	48 lbs.	45 lbs.
Graded	Yes	Yes	Yes	Yes
Treated	Copper carbonate	Copper carbonate	Copper carbonate	Copper carbonate
Rate of super.	90 lbs.	110 lbs.	94 lbs.	80 lbs.
Type of drill	Spring tyne combine	Rigid tyne combine	Combine	Spring tyne and rigid tyne combines
Disease	....	....	Several patches of Take-all	Several patches of Take-all

Competitor	Metcalf, E. A.	Lines, W. H.	Goodie, H.
Years cropped	20 years	28 years	10 years
Timber	Breaking into Mallee; Salman Gum, Gimlet	Salmon Gum, Gimlet	Sand plain scrub
Ploughed	Mid July	Late November	Mid July
Type of plough	Rigid tyne cultivator	Disc cultivating	Disc cultivating
Depth	4 in.	Not known	4 in.
Other cultivations	Disc cultivating plough in early September. Rigid tyne in early May. Combine mid May	Disc cultivating plough just prior to seeding	Rigid tyne cultivated mid May
Variety	Bungulla	Bungulla	Bungulla
Planted	20th May	17th May	7th June
Rate of seed	50 lbs.	56 lbs.	50 lbs.
Graded	Yes	Yes	Yes
Treated	Copper carbonate	Copper carbonate	Copper carbonate
Rate of super.	90 lbs.	95 lbs. (top-dressed 1946, 65–70 lbs.)	112 lbs.
Type of drill	Rigid tyne combine	Combine	Combine
Disease	....	Patches of Take-all and some Flag Smut	....

ZONE IV.

Field Judge—E. R. WATSON, Agricultural Adviser.

In this zone there were only 3 competitors, including the first and second prize winners of a local competition conducted by the Mt. Marshall District Agricultural Society.

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Gobbard & Son....	Gabbin	Bungulla	21	9	9	28	67
Collins, H. J.	Bencubbin	Bungulla	20	9	8	29	66
Watkins, A. H.	Karloning	Bencubbin	15	9	9	28	61

The winning crop, entered by Messrs. Gobbard & Son of Gabbin, was of the variety Bungulla sown on former Salmon Gum and Gimlet timber country and cropped on a 3-year rotation. It had been planted during the third week in May at the rate of 45 lb. of seed with 90 lb. of super to the acre and returned a calculated yield of 21 bushels per acre.

Mr. H. J. Collins' entry, also of the variety Bungulla, which gained second place, was down and tangled in places and showed patches of "Take-all". This crop was planted at the end of April at the rate of 50 lb. of seed and 100 lb. of super to the acre on former Salmon Gum, Ti-tree and Mallee timber country which of recent years had been cropped on a 3-year rotation.

The crop of Bencubbin entered by Mr. A. H. Watkins of Karloning had suffered considerably from drought conditions.

Rainfall figures during 1947 for the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Gabbin	33	....	450	86	196	221	158	78	82	125	860	36	....	1,465
Bencubbin	34	15	277	59	159	200	151	57	69	177	813	103	....	1,301
Karloning	75	29	90	63	159	157	163	63	95	179	816	20	....	1,093

The season started off well but the lack of beneficial rain during August and September seriously affected the crops and practically all entries at the time of inspection showed the effects to a greater or lesser extent. Frosts were widespread during the winter months, but little damage was evident in the grain.

The average yield of all the competitors in the zone was just over 18 bushels per acre, and having regard to the growing conditions this must be considered satisfactory.

Cultural details are as follows:—

Competitor	Gobbard and Son	Collins, H. J.	Watkins, A. H.
Years cropped	25 years	25 years	14 years
Timber	Gimlet and Salmon Gum	Salmon Gum, Ti-tree, Mallee Scrub	Salmon Gum, Black Mallee
Ploughed....	July	August	July
Type of plough....	Disc	Disc	Disc cultivating
Depth	3in.	2½in.	4—5in.
Other cultivations	Ploughed back in September, ploughed again in April	Cultivated just prior to seeding with spring tyne combine	Ploughed back with disc cultivating plough in September. Cultivated with Rigid tyne late April
Variety	Bungulla	Bungulla	Bencubbin
Planted	17th May	End of April	3rd to 10th May
Rate of seed	45lbs.	50lbs.	39lbs.
Graded	Yes	Yes	Yes
Treated	Copper Carbonate	Copper Carbonate	Copper Carbonate
Rate of super	90lbs.	100lbs.	90lbs.
Type of drill	Rigid tyne combine	Spring tyne combine	Spring tyne combine
Disease	....	Slight Take-all infection	....

ZONE V.

Field Judge—A. J. T. MARSHALL, Agricultural Adviser.

There were six competing areas submitted to the judge for inspection. Final awards were made as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Latham, A. W.	Narembeen	Bencubbin	29	9	9	27	74
Cuming, J.J. & Sons	Korbel	Bencubbin	26	9	9	27	71
Hebbermann, H.	Emu Hill	Bungulla	26	8	9	26	69
York, H. S.	Tammin	Bencubbin	25	8	9	26	68
Jacob, H. S.	Belka	Bungulla	22	9	9	26	66
Quick, H. E.	Collgar	Bungulla	23	9	9	....	....

Mr. A. W. Latham's crop of the variety Bencubbin was part of 100 acres of the same variety sown on land which had originally carried Salmon Gum and Gimlet timber and cropped in a four year rotation of fallow, wheat, oats, pasture. The crop was calculated to yield 29 bushels per acre and had been sown on the 18th May with a combine at the rate of 43 lb. of seed and 93 lb. super per acre.

The entry which gained second place was that of the variety Bencubbin grown by Messers. J. J. Cuming and Sons of Korbel which returned a calculated yield of 26 bushels per acre. Grown on former Salmon Gum Gimlet timber country, this crop had been sown on 14th May at the rate of 60 lb. seed and 112 lb. of super per acre.

The details regarding the rainfall during 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May	June	July	Aug.	Sept.	Oct.	Total	Nov.	Dec.	Total for year
Narembeen	3	8	35	202	219	255	164	59	67	237	1,001	74	4	1,327
Belka	....	55	73	150	203	254	193	70	51	241	1,012	40	....	1,330
Emu Hill	....	6	45	171	212	281	177	60	56	168	954	95	*	....
Tammin	....	4	20	168	238	297	228	58	86	173	1,080	42	....	1,314
Merredin	7	2	95	110	180	253	191	51	78	215	968	68	11	1,261

*Not available.

Crops in this zone must be considered highly satisfactory particularly when it is remembered that in August and September a prolonged dry spell coupled with severe frosts, was experienced and much anxiety was being felt as to the harvest prospects.

For all crops in the competition, the calculated average yield was slightly over 25 bushels per acre.

Cultural details for the entries are set out for comparison as follows:—

Competitor	Latham, A. W.	Cuming, J. J. and Son	Hebbermann, H.
Years cropped	Over 20 years	Over 20 years	30 years
Timber	Gimlet and Salmon Gum	Salmon Gum and Gimlet	Salmon Gum, Gimlet and Morrel
Ploughed....	June	June	July
Type of plough....	Mouldboard	Disc	Mouldboard
Depth	4in.	3in.	3in.
Other cultivation	Combined in August, March and May	Scarified in August and May	Cultivated in September and May
Condition of land at ploughing	Wet	Wet	Boggy
Variety	Bencubbin	Bencubbin	Bungulla
Planted	18th May	14th May	24th May
Rate of seed	43lbs.	60lbs.	45lbs.
Seed graded and pickled	Yes	Yes	Yes
Rate of Super	93lbs.	112lbs.	150lbs
Type of drill	Spring tyne combine	Rigid tyne combine	Spring tyne combine
Disease	....	....	....

Competitor	York, H. S.	Quick, H. E.	Jacob, H. S.
Years cropped	30 years	Over 15 years	Not known
Timber	Salmon Gum, Gimlet and Mallee	Salmon Gum, Gimlet and Morrel	Salmon Gum, Gimlet
Ploughed....	5th—18th July	July	July
Type of plough....	Disc	Disc	Scarifier
Depth	3½—4in.	4in.	3in
Other cultivation	Cross ploughed September, cultivated 8th May	Scarified September and May	Scarified August and April
Conditions of Land at Ploughing	Wet	Dry and hard	Moist (Good)
Variety	Bencubbin	Bungulla	Bungulla
Planted	25th–29th May	End of May	10th May
Rate of seed	55lbs	45lbs.	45lbs.
Seed graded and pickled	Yes	Yes	Yes
Rate of super	90lbs.	90lbs.	110lbs.
Type of drill	Spring tyne combine	Spring tyne combine	Spring tyne combine
Disease	....	....	....

ZONE VI.

Field Judge—A. J. T. MARSHALL, Agricultural Adviser.

There were five competitors in this zone and the awards made are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Moir, G. R.	Borden	Kondut	44	9	9	26	88
Caterer, B. M.	Gnowangerup	Bencubbin	39	9	9	28	85
Murray, A.	Tinkurrin	Bencubbin	32	9	9	26	76
Hams, T. H.	Gnowangerup	Bencubbin	32	9	9	25	75
Jefferis, J.	Wagin	Bungulla	38	9	9	....	....

Mr. Gerald Moir's crop of the variety Kondut was outstanding, and in addition to winning first prize in this zone, gained the State Championship award. This crop, sown at the rate of 45 lb. of seed and 90 lb. of super per acre on the 28th May was tall, dense, and very even. The original timber on this red loam land was York Gum and Jam and had been cropped for 20 years on a three-year rotation of fallow-crop-pasture.

The entry which gained second place was a crop of the variety Bencubbin grown by Mr. B. M. Caterer of Gnowangerup. This, another excellent crop, returned a somewhat lower calculated yield than Mr. Moir's Kondut but obtained higher points for baking quality.

This crop had been planted on 21st May on former Morrell and York Gum timber country at the rate of 60 lb. of seed and 112 lb. of super per acre. This competitor also gained third place in the State Championship award.

The crop entered by Mr. J. Jefferis of Behn-Ord estate was calculated to yield 38 bushels but as the strength figure of the grain as determined by the farinograph, for baking quality, was less than five minutes, it could not qualify for the State Championship.

Rainfall data for 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Borden	6	62	15	279	237	356	166	103	156	321	1,339	96	6	1,803
Gnowangerup	4	75	4	490	256	421	169	80	120	274	1,320	63	....	1,956
Nippering	2	73	39	259	316	451	136	72	118	207	1,300	16	9	1,698
Wedin	4	59	5	261	316	369	131	140	75	279	1,310	27	18	1,684

Although dry conditions prevailed during August and September the growing conditions for the season would be considered satisfactory, particularly as copious rains during October were in time to fill out the heavy yielding crops. The crops in these areas normally mature somewhat later than is the case in other zones.

Cultural details of competing areas are as follows:—

Competitor.	Moir G. R.	Caterer B. M.	Jefferis J.	Hams, H. T.	Murray, A.
Years cropped....	20 years	Not known	4th crop, not known	40 years	3 crops in 11 years
Timber	York Gum and Jam	Morrel and York Gum	SalmonGum,Morrel, York Gum Jam	Morrel and York Gum	SalmonGum,Morrel, York Gum, Jam
Ploughed	July	July	August	Mid July	April
Type of plough	Scarifier	Mould board	Scarifier	Scarifier	Scarifier
Depth of ploughing	3 in.	3–4 in.	3 in.	3 in.	3 in.
Other cultivations	Disc ploughed, October. Scarified April, Scarified May	Cultivated October, December, April	Scarified November, Scarified April	Disc ploughed, August. Scarified April	Cultivated end of April.
Variety	Kondut	Bencubbin	Bungulla	Bencubbin	Bencubbin
Planted	28th May	21st May	3rd June	20th May	27th May
Rate of seed	45lb	60lb	45lb	60lb	50lb
Gradedandpickled	Yes	Yes	Yes	Yes	Yes
Rate of super	90lb	112lb	100lb	120lb	90lb
Type of drill	Rigid tyne combine	Spring tyne combine	Spring tyne combine	Rigid tyne combine	Rigid tyne combine
Disease	....	....	....	....	....

ZONE VII.

Field Judge—A. J. T. MARSHALL, Agricultural Adviser.

There were six entries in this zone, including two nominated by the Karlgarin District Agricultural Society. However, owing to withdrawals only two remained at the time of inspection. The points awarded are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Hudson, G.	Newdegate	Ford	22	9	9	28	68
*Marshall, H. J.	Hyden	Bencubbin	21	9	9	....	....

*Did not qualify for an award due to too low Baking Strength.

Mr. G. Hudson's entry of the midseason variety Ford was the winner with a calculated yield of 22 bushels per acre.

The competing area had been planted during the second week in May on former Salmon Gum, Blackbutt, and Mallee timber country, which for some years had been cropped on a fallow-wheat-oats two-years pasture rotation.

The entry made by Mr. H. J. Marshall with a crop of the variety Bencubbin was calculated to yield one bushel per acre less than Mr. Hudson's crop but the baking quality did not reach the required standard and was, therefore, not eligible for a prize.

The rainfall data for 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Newdegate	....	78	111	188	136	243	155	40	71	218	863	62	15	1,317
Hyden	3	66	46	171	135	203	170	63	72	158	801	32	....	1,119

Cultural details for the competing areas are as follows:—

Competitor.	Hudson, G.	Marshall, H. J.
Years cropped	5 crops in 19 years	17 years
Original timber	Salmon Gum, Blackbutt, Mallee, Morrel	Salmon Gum, Gimlet, Mallee.
Ploughed	July, August	August
Condition of land	Fairly good	very wet.
Implement	Disc	Disc
Depth	3–4 in.	4 in
Subsequent cultivations ...	Scarified in late April	Cultivated late March–April
Variety	Ford	Bencubbin
Planted	2nd week May	1st week in May
Rate of seed	50lb	42lb
Rate of super	120lb	90lb
Graded and treated	Yes	Yes
Type of drill ...	Spring tyne combine	Spring tyne combine
Disease		

DISCUSSION.

THE conducting of wheat crop competitions serves a very useful purpose in connection with advisory work to wheatbelt farmers. From a study of the results of the cultural and other operations carried out by the individual competitors, the reasons for the high yields quite often obtained, can be assessed. There are also a number of interesting points which arise from perusal of the results and data available.

As indicated earlier, this competition is unique in that the factor of baking strength is taken into consideration in determining the awards made. From time to time doubt is expressed as to the quality of the wheats being grown in this State, with particular regard to the standard wheats most commonly grown. With both seasons' competitions, the varieties included were all of the standard varieties and each year those included were planted to over 60 per cent. of the area sown to

wheat for all purposes in Western Australia. Details of the number of crops sown to the different varieties in each of the zones and in each year, are set out in the following table:—

	Bencubbin.		Bungulla.		Eureka.		Kondut.		Koorda.		Ford.		Total.	
	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.
Zone 1	1	2	....	4	....	1	....	....	1	....	....	....	2	7
Zone 2	....	1	3	4	....	....	....	2	....	2	....	....	3	9
Zone 3	2	2	2	5	....	....	1	....	....	....	....	....	5	7
Zone 4	1	1	7	2	....	....	....	....	....	....	....	....	8	3
Zone 5	2	3	4	3	....	....	....	....	....	....	....	....	6	6
Zone 6	1	3	1	1	....	....	....	1	....	....	....	....	2	5
Zone 7	3	1	4	....	....	....	....	....	....	....	....	1	7	2
Total	10	13	21	19	....	1	1	3	1	2	....	1	33	39

It will be noted from the above table that in each year approximately one-third of the crops were sown to Bencubbin and 60 per cent. to Bungulla. These two varieties are the main standard wheats grown in this State, at present being used for just over 54 per cent. of the acreage. Of the other varieties grown, the performances of the late midseason variety Kondut, must be considered very meritorious as in 1947 in addition to winning the State Championship, it was the winner in two zones. This variety is particularly useful for sowing on ploughed up clover land, on light land and under high rainfall conditions. The variety Koorda is the early maturing counterpart of Kondut and has achieved quite considerable popularity over the last few years.

Eureka is a midseason maturing rust resistant variety which of recent years has unfortunately been found to be susceptible to a new biotype of rust race 34.

In connection with the baking strength of the grain of the individual crops, the details of the number of crops in each zone gaining 25 points or more in each of the two years, are set out below:—

Points	30		29		28		27		26		25		*Nil*	
Year	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947	1946.	1947.
Zone 1	1	....	....	....	1	2	....	3	....	2	....	....	....	...
Zone 2	1	1	2	1	....	1	....	2	....	3	....	....	....	1
Zone 3	....	....	2	....	....	....	2	4	1	3	....	....	...	....
Zone 4	6	....	2	1	....	2	....	....	....	....	....	....	....	....
Zone 5	....	....	4	....	1	....	1	2	....	3	....	....	....	1
Zone 6	....	....	1	....	....	1	....	....	....	2	....	1	1	1
Zone 7	....	....	1	....	4	1	....	....	2	....	....	....	....	1
Total	8	1	12	2	6	7	3	11	3	12	....	1	1	4

It will be noted from the above table that in 1946, 26 of the competing crops gained 28 or more points, but in 1947 only 10. In 1946 20 crops gained 29 or more points, but in 1947 only three.

It will also be noted that in 1946 in Zone 4, six crops gained the maximum points and the other two 29. Of these crops seven were of Bungulla and one of Bencubbin, the Bencubbin gaining the maximum points. Maximum points were also gained by the crop of Bungulla which won the State Championship.

It should be noted also that in that year only one crop failed to become eligible for consideration for an award. This crop, of the variety Bencubbin, was grown under higher rainfall and lighter soil conditions than most of the other crops of that variety.

With the 1947 competition, the baking strength factor had a definite bearing not only on some of the place getters, but in two zones the returning of good strength figures determined whether or not some of the competitors would be eligible for inclusion in the competition results. With this year also, four crops failed to become eligible for an award due to their returning strength figures of less than five minutes, as determined upon the farinograph.

The finishing conditions in the two seasons were totally different, inasmuch as in 1946 there was a lack of beneficial finishing rains, whereas in 1947 most districts received good late finishing rains. The receival of these good rains would have a lowering effect on the baking strength of the crops, whereas the previous year the hard finishing conditions were conducive to higher strength figures.

These results clearly indicate that the strength of the grain of any variety is dependent not only upon its inherent capacity for strength, but also the soil, environmental, and climatic conditions. It will, therefore, be seen that under suitable soil and climatic conditions, the standard Western Australian varieties are capable of producing grain of "Filler" strength.

With regard to cultural operations, the following are brief comments on the individual phases:—

Fallowing.

In 1946 all of the crops were planted on land which had been fallowed the previous year, but in 1947 two were planted on ploughed up land. Both of these crops returned excellent yields one, of Eureka, planted on old pasture land, gained second prize in Zone I and the other of Bencubbin, second prize in the local competition conducted by the Three Springs Agricultural Society.

In the past all the experimental and other evidence has indicated that fallowing for the wheat crops is essential for maximum production. Today with the accent quite largely on pasture improvement and soil conservation, the necessity for fallowing is not always of paramount importance. In some districts, and in the lower rainfall areas in particular, this practice must, however, continue to ensure maximum yields.

The implement most favoured for ploughing was the disc type, approximately two-thirds of the crops in each year being planted on disc ploughed land. The rigid tyne cultivator or scarifier was next favoured and there were only a few areas on which the mouldboard was used.

Time of Seeding.

The time at which the crop is planted is determined firstly, by the maturity of the variety being used and secondly, by the actual seasonal conditions experienced. The planting of a variety at the right time considerably assists in ensuring maximum production within its capacity, but if planted out of season, then yields are likely to be considerably depressed, either due to lack of sufficient growing period or to disease due to early planting.

With regard to the competition itself, the time of planting varied from late April to late June. The major portion (over 90 per cent.), was, however, planted during the month of May. All of the experimental evidence available indicates that May is the most suitable month for the sowing of the wheat crop. Seeding calendars are published from time to time in the Departmental Journal, covering periods for the seeding of the individual recommended varieties.

Rate of Seeding.

The different rates of seeding used by the individual competitors ranged from 30 to just over 60 lb. per acre, but the majority used in the vicinity of 45-56 lb. per acre. This rate is in conformity with the recommendations based on the results of the experimental work carried out over a number of years, which indicated that there was no necessity, except under exceptional circumstances, to use a greater rate than 45 lb. per acre. Most of the crops planted with less than 45 lb. per acre were in the lower rainfall areas where the lower rates have been found to be economical.

Rate of Superphosphate.

The rates of superphosphate used cover the wide range of from 60-180 lb. per acre, but approximately 90 per cent. of the crops were dressed with from 90-112 lb. of super. This is the normal rate recommended for use with the wheat crop.

Disease.

Many years ago one of the main diseases which had to be contended with by the wheat farmer, was Ball or Stinking smut, but through the use of fungicides such as copper carbonate or one or other of the proprietary mercury compounds, little or no ball smut is now found in wheat samples. With all of the crops, the seed used was treated with one or other of the above fungicides.

With regard to the crops as a whole, the evidence of disease was comparatively slight, there being in places some evidence of "Take-all" and to a lesser degree flag smut and septoria. "Take-all" is a disease which causes serious losses in some years and it is pleasing to note that with the competition crops, the incidence was small and the effect on yields slight. The minor presence of these diseases is undoubtedly due to the sound farming practices of the competitors.

With regard to stem rust in wheat, which occurs periodically in epidemic form in some districts, there was practically no evidence of it occurring at all on any crop.

CONCLUSION.

As mentioned earlier wheat crop competitions were an important phase of wheatbelt agriculture in prewar days assisting materially in the improvement of farming practices in these areas and serving as a very useful vehicle in extension and advisory work amongst farmers. The Western Australian Flour Millowners' Association is, therefore, to be highly commended in not only sponsoring the recommencement of such competitions and donating the very substantial prize money, but in having included in the conditions of the awards, points for the baking quality of the flour obtained.

The results of the competition to date will be gratifying to the sponsors, though the entries received might possibly have been greater particularly in view of the magnitude of the awards.

PREPARED BAITS FOR WILD DOGS AND FOXES.

A. S. WILD, Chief Inspector, Vermin Branch.

DURING past years the active measures of farmers and pastoralists, in destroying both foxes and wild dogs on and near their properties, have been hindered by the difficulty in obtaining suitable supplies of material and, in some cases, inconvenience of preparing suitable baits. Many people have an aversion to handling a poisonous material such as strychnine, especially in the powdered form, which was generally used. Also many hastily prepared baits contributed to make wild dogs bait-shy, and therefore increased the difficulties in destroying these animals.

The projected aerial baiting activities in the more inaccessible parts of the State also necessitated that well prepared and easily preserved baits be available in large quantities. Prepared baits have been manufactured in other States, the material used being cooked brisket fat, and the Western Australian Department of Agriculture conducted investigations into the various types of material which might be available for the manufacture of large quantities of baits in this State.

It was obvious that baits when prepared would be eagerly sought by vermin boards for resale to pastoralists and farmers in their areas, and a suggestion was made to Messrs. David Gray & Co. Ltd. that they assist in the investigations and proceed with the manufacture when a suitable formula was decided upon. Through the co-operation of the management of Robbs Jetty Abattoirs supplies of brisket fat were obtained from the boning of beef carcases, and these were saved and treated by cooking in brine solution. The brisket fat was cut into one-inch cubes and at the factory half-grain tablets of strychnine were inserted into each cube. The material was then wrapped in parchment paper and the experimental baits tried out under field conditions. However, supplies of brisket fat available at the abattoirs near Perth were limited and it was decided to investigate the possibilities of using material such as ewe's udder. Experiments eventually indicated the right cooking treatment for this material, which was at least equal to brisket fat, making an attractive bait for dogs, and also with a texture to hold the strychnine tablet firmly in the centre of the bait.

Further experiments have indicated that some modification must be made to the wrapping paper, parchment paper proving too stiff to be easily removed by the wild dogs. Also there is a danger that sufficient odour would not come from baits so wrapped to attract dogs and foxes, which rely so much on the sense of smell. The alternative wrappings suggested for the manufacture of baits are blank newsprint paper and tissue paper somewhat similar to that used for wrapping apples for export. It was desirable that baits should be so wrapped not only as a protection against ants, but also to provide packing in the boxes. A further modification might follow experiments with the colouring of the paper

green, as this colour is less likely to attract birds and therefore will provide a greater economy in baits and reduce the hazard of wholesale destruction of bird life which might be beneficial to agriculture.

The use of strychnine tablets has greatly facilitated the preparation of the baits and this was a great improvement on the old method of roughly measuring the desired quantity of powdered strychnine with its attendant waste and danger. The tablets also avoided the probability of leaving portion on the outside of the baits, which would tend to educate wild dogs to be bait-shy.

The manufacturing firm is now producing the baits at the rate of approximately 15,000 per week and orders have been placed by many local boards and also the Department of Agriculture for large quantities. The baits are packed in cases which hold 1,000, but smaller cases each containing 200 baits are available for sale especially in agricultural areas where quantities used on individual farms will be considerably less than those required in pastoral districts. It is considered likely that the distribution to individual pastoralists and farmers will be made through the local vermin boards purchasing direct from the manufacturing firm. The price will be approximately £4 per 1,000, which is comparable with that charged in Queensland.

COPPER DEFICIENCY OF CEREAL CROPS IN WESTERN AUSTRALIA.

T. C. Dunne, Plant Nutrition Officer.

THE excellent results achieved, since 1938, by Teakle and various co-workers from the use of copper containing materials as fertilisers, have been recorded in some detail in a number of papers published in previous volumes of this Journal. Inquiries concerning copper deficiency problems are still being received from farmers but unfortunately reprints of most of these articles are no longer available.

It is the purpose of this paper, therefore, to review briefly the information obtained in this State concerning copper as a fertiliser in the hope that it may serve as a guide to those interested in cereal growing.

Where Copper Deficiency May Occur:

Copper deficiency as determined by responses to applications of copper containing fertilisers has been found to occur in widely separated portions of the State. The accompanying map prepared by Teakle in 1942 (Fig. 1) shows the locations where responses have been obtained, either by Departmental experiments or by tests made by farmers.

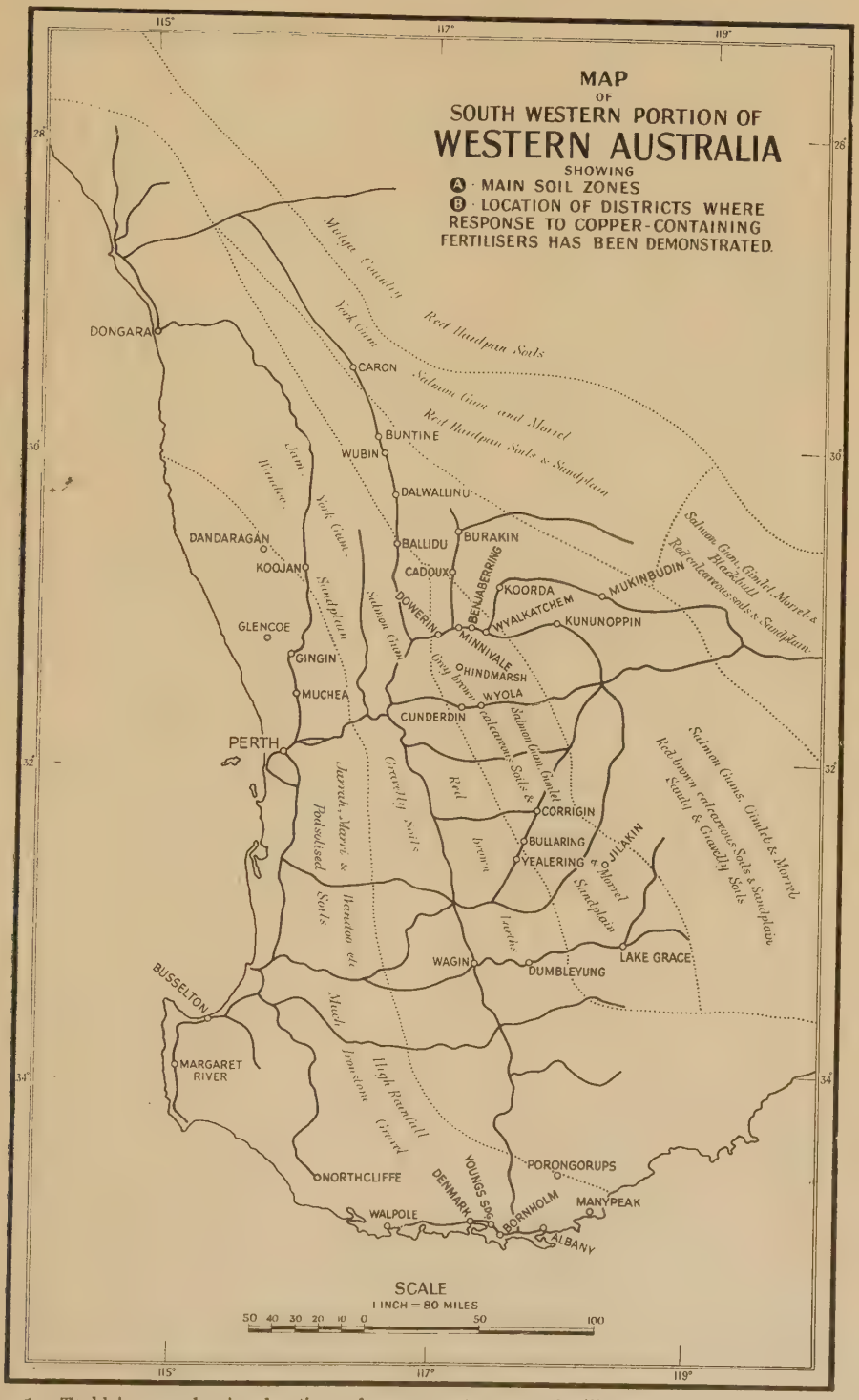


Fig. 1.—Teakle's map showing locations of responses to copper fertilisers, up till 1942.

Certain soil types are more likely to be deficient than others. Brief descriptions are therefore given hereunder of a number of types on which the deficiency may occur:—

1. The high level sandy and gravelly soil types of the main wheatbelt and the Great Southern areas. Both types are, in many instances, underlain with gravel, usually at shallow depth.

   Wodjil scrubs are associated with a number of these deficient areas. Deficiency may also occur on similar soil types which carried tamma, broombrush, mallee or stunted wandoo (white gum). In the more westerly affected areas, jarrah is often dominant in the natural vegetation.

   These sandy and gravelly soils include most of the copper deficient areas on which cereals are grown.

2. The main soil types of the Dandaragan and Gingin districts. Among these are the grey to brown coloured light soils of flats which carried mainly flooded gum, and the red sandy soils normally carrying marri (red gum) and banksia.

Fig. 2.—Bending over of wheat stems due to moderate copper deficiency.

3. Coastal soils high in lime. These include the fine sands associated with limestone or soft lime and on which wattle comprises the chief natural vegetation. Cereals are grown on the Dongara and West Northampton examples of this type.

   Sandy soils of the west coast and the marly peat swamps of the Albany area are also included under this heading.

4. Sandy surfaced soils of the Busselton-Augusta area on which marri and scattered jarrah was the dominant native vegetation.
5. Some of the acidic soil types, often sandy, of the Albany district. As well as peaty swamps, there are included sandy types high in organic matter on which bottlebrush predominated.

Responses to copper containing fertilisers have been obtained on a few areas which do not fit into the above groups but these are of limited extent.

No response to copper has, in general, been observed on the heavier soil types of the wheatbelt.

Symptoms of Copper Deficiency.

The symptoms produced in plants by an insufficient supply of copper vary considerably with the severity of the deficiency. With cereals deficient plants are paler in colour than are normal plants of the same variety and the root development is considerably reduced. A brief summary is made of symptoms for the more important cereals.

(a) *Wheat.*—In the more severe cases, symptoms may be seen when the plants are four to six weeks old. Associated with poor growth, there occurs a yellow tipping of the leaves and a limpness of the foliage. Usually such plants either die completely or, as the older leaves die, new ones are produced. No heads are formed by such severely affected plants.

Where the deficiency is less acute, plants may appear normal till early spring when leaf tipping, failure of the stems to elongate and loose heads with sterile florets are noted. A purplish-grey discoloration of the leaf sheaths gives the stems a dark coloration.

Sometimes, normal growth occurs until November when the deficiency causes the formation of dummy heads, which, because of the absence of grain, stand very erect. Discoloration of the leaf sheaths is fairly general.

Few growth abnormalities may be visible with moderate deficiency but many of the heads are empty or only partly developed. Due to the weakness of the straw partly filled heads may bend over excessively (Fig. 2) or, in some cases, may even snap off.

(b) *Oats.*—In acute cases, paleness and drooping of oats plants may be noticed about four weeks after germination. The tips and edges of the most recently emerging leaves develop a white or light yellow appearance. The tips later die, become coiled and develop a stringy appearance with frayed edges (Fig. 3). This appearance is quite characteristic of the deficiency.

In less severe instances, symptoms appear at a later date. Growth is poor, the internodes are shortened and the straw is weak. Secondary tillers which never mature may appear. If heads are formed, the glumes are frequently white and papery and are empty of grain.

Sometimes, symptoms are not pronounced but yields are low owing to the grain being small and shrivelled. Secondary tillers may be present. Ripening is distinctly delayed.

(c) *Barley and Rye.*—The copper deficiency symptoms of barley are, in many respects, similar to those of wheat. The younger leaves of deficient plants show a whitish or yellowish tipping and a yellow edging. The leaf sheaths are pale and the stems are weak and prostrate. Root development is poor and the plants are easily pulled from the soil.

Rye usually makes better growth than do the other cereals on copper deficient country. Nevertheless, in some areas, the heads may be empty of grain or only the bottom half filled. Secondary growth from the bottom of the plants is frequently seen.

Diagnosis of Copper Deficiency.

Definite diagnosis of copper deficiency is usually difficult unless the trouble is very acute when the small dead plants display the typical symptoms. Poor root development, the presence of dummy heads, the bending over of heads or disappointing grain yields as compared with the vegetative growth, all give ample ground for suspicion but not for certainty.

Unfortunately, analyses of plant material for copper content do not necessarily give reliable information. In the early growth stages such analyses may be useful, but it is often difficult to determine whether plants are small because they are young or because they are stunted.

Fig. 3.—Copper deficient oat plant showing stringy dead tips and poor root development.

Soil analysis is of no use. Differences in responses to copper containing fertilisers may be due, not to variations in copper content, but to differences in availability of that element. At present, there is no reliable test for determining availability.

Where sheep are carried, an examination of the wool may help decide whether trails with copper are warranted. Where the herbage is low in copper, the wool may loose its crimp and bulk and become "stringy" or "steely." If this occurs on areas where some of the plant symptoms described above are noted, trials should be worth while.

The best method is to sow trial strips of copper containing fertilisers across the areas where the deficiency is suspected. Control strips where superphosphate or the customary manurial treatment is applied should be left for comparison, Frequent observations should be made to determine any differences. However,

as copper may affect grain yields without any observable growth changes, it is *essential that the strips be harvested separately* before any conclusion concerning the efficacy of treatment can be reached.

Unfortunately, there do occur instances where the value of added copper may be masked by the fact that some other element is restricting growth. In this connection, a condition was noted recently where the full benefit from copper was obtained only where a zinc compound was applied as well. However, at present, it is believed that areas where this is likely to occur are not common. The copper strip method suggested is therefore suitable for use in most circumstances.

The use of Copper Containing Fertilisers.

In the early experiments conducted to determine responses to copper containing fertilisers, bluestone (copper sulphate) was used at rates up to 20 lb. per acre. Later trials showed that lower rates achieved equally satisfactory results and it was eventually recommended that, on copper deficient soils, bluestone be applied mixed with the superphosphate, at the rate of 5 lb. per acre. Higher rates may cause injury and it has been found that, on a few very sandy types, even 5 lb. per acre could be damaging.

At a later date it was demonstrated that oxidised copper ore could be used as a substitute for bluestone providing the same amount of copper was added per acre. This provision is necessary as bluestone contains about 25 per cent. copper whereas the copper content of oxidised ore usually available may vary from 5 per cent. to 25 per cent., with higher figures from selected samples. If 5 lb. of bluestone (25 per cent.) is to be replaced by a copper ore containing 10 per cent. copper then 12½ lb. of such ore is necessary to ensure that the same quantity of the desired element was being added by each method.

At the present time "copperised" superphosphates are available, which may contain either bluestone or oxidised copper ore as a source of copper. The copper content of both fertilisers is about the same but, as the oxidised ore is the cheaper source, the bulk of the copperised superphosphate available is, where practicable, made by including this latter material.

Data have been also obtained which show that there is a residual effect on subsequent crops of copper applied in previous years. It is therefore recommended that where fertiliser giving the copper equivalent of 10 lb. per acre of bluestone, either as one dressing of 10 lb. or two dressings each of 5 lb., has been applied that no further copper be added, for the purpose of improving plant growth, during the next five years. Sufficient data are not available to decide definitely whether the requirements of animals, are, under all conditions, met by applications spread over such a period. In any case, when the initial soil deficiency has been overcome, annual applications of copper are not necessary.

CONCLUSION.

The benefit to plant growth to be derived from the use of copper on certain soil types has been well demonstrated by the work of investigators during past years. Other workers have shown equally well, the value of this element in animal husbandry.

However, it is necessary that the material, which is not cheap, be used intelligently. Although a number of soil types have been mentioned on which the deficiency occurs, it must be remembered that a great deal of the cereal production of the State takes place on the heavier soils, the clays and loams, which are amply supplied with copper and which give no additional yield with copper fertiliser.

Where deficiency is suspected farmers should make the necessary observations of crops at various growth stages and when in doubt, an attempt should be made, during the growing period of the crop, to obtain the advice of the district agricultural officer.

PHALARIS TUBEROSA.

In the December 1947 issue of this Journal reference was made to the certification of *Phalaris tuberosa* seed in Western Australia. Photographs have since been received from Mr. F. E. Hitchins showing excellent stands of this grass on his property at Cranbrook.

Mr. Hitchins has co-operated with the Department in carrying out a number of experiments, especially in connection with the "stalling" of subterranean clover. Trials have demonstrated the value of introducing perennial grasses to clover pastures. Besides providing more nutritious and palatable grazing, the grasses reduce the extent of intrusion of such weed species as wild geranium (*Erodium Botrys*) and capeweed (*Cryptostemma calendulaceum*) along with annual grasses which tend to dominate old swards of subterranean clover.

Plate A shows a dense stand of Phalaris sown in 1938. This adjoins a paddock in which the subterranean clover has been replaced entirely by a prolific growth of weeds.

A.—Phalaris tuberosa sown 1938.
(Photo: F. E. Hitchins.)

Plates B and C are different views of a paddock sown in 1939. This soon developed into a well balanced pasture of Phalaris and subterranean clover. It was cut for hay in 1945 and harvested for seed in the two subsequent seasons.

As in all crops and pastures the most important factor in success with Phalaris tuberosa, apart from soil and district, is the seed used in the original sowing. Even under the best conditions of soil and cultural practice in an ideal environment, little success can be expected from a pasture sown down with an inferior line of seed. Only by buying certified seed of known purity and germinating capacity can a farmer be sure that the product is of first quality, and capable of producing a pasture of the type desired.

A different approach, and one that has been used with great success by Mr. A. L. B. Lefroy at Chittering, is the selection of seed from a single outstanding plant, as near as possible to the ideal requirements of the species, and the

B.—Phalaris tuberosa sown 1939. Cut for hay 1945. Harvested for seed 1946 and 1947.
(Photo: F. E. Hitchins.)

subsequent building up of stocks of the seed as a pure line. About 10 years ago Mr. H. C. Trumble of the Waite Agricultural Research Institute, Adelaide, gave Mr. Lefroy a few seeds from one such plant which he had selected in the pastures at the Institute. During the intervening years Mr. Lefroy has increased his stock of seed, carefully guarding against the possibility of interbreeding between the Waite seed and inferior strains, until now he has 350 acres of excellent pasture all sown with seed derived from the few original ones from the Waite. A section of this pasture is illustrated in Plate D.

The amount of feed provided by the paddock can be gauged from the fact that after fattening one bullock to the acre, Mr. Lefroy still had sufficient feed left to graze a large flock of sheep.

C.—Another view of the paddock shown in "B."
(Photo: F. E. Hitchins.)

D.—Section of the 350 acre area of phalaris tuberosa and mid-season subterranean clover.
(Photo: A. L. B. Lefroy.)

WHEAT VARIETY TRIALS.

By I. THOMAS.
Superintendent of Wheat Farming.

THE aim of the cereal breeders is not only to produce a variety which is inherently capable of giving high yields, but which includes in its characteristics resistance to the complex of plant diseases, thus enabling it to produce to its maximum. With respect to disease, plant breeders' efforts at present are directed particularly to the production of rust resistant varieties.

With cereal breeding many promising types result from the crossing of two varieties and the selection of the most suitable necessarily entails comparison with the standard varieties which it is desired they will replace.

In the earliest stages of selection, micro or small scale yield trials are conducted in the plant breeding rows and later the more promising crossbred material is subjected to testing in the larger variety trials under field conditions.

Due to the diversity of soil and climate conditions in Australia, varieties bred in other States, although they may be particularly successful in the State in which they are produced, do not necessarily yield up to their reputation when introduced into other areas with different soil and climatic conditions. As a means of comparison wheat variety trials under field conditions are carried out each year at the Research Stations to test new and introduced varieties, and crossbred material produced at the Research stations against Bencubbin and Bungulla, the standard midseason and early maturing varieties respectively, which between them represent over 56 per cent. of the 1946 acreage sown to wheat for all purposes in Western Australia.

The "pure line breeding" section of the Test Rows which serves to keep varieties breeding true for the varietal characteristics as the initial step in the production of pedigree seed.

SEASONAL CONDITIONS.

Seasonal conditions throughout the wheatbelt during 1947 varied considerably and the following is a brief summary of the conditions experienced at each of the Research Stations:—

Brush enclosures at the Merredin and Wongan Hills Research Station, where with the help of irrigation rust epidemics are produced for testing new crossbreds.

Avondale:—Seasonal conditions at this Station were very satisfactory throughout the growing period and crops did not suffer unduly from the dry August-September conditions as in the less favoured districts. The crops definitely benefited from the late finishing rains experienced in October.

Chapman:—At this Station also, germination and early growth was very satisfactory although some crops tended to be rather weedy. Despite reasonably good finishing conditions, yields were not up to expectations.

Merredin:—The early growth period was good but the abnormal low rainfall in August and September, coupled with severe frosts caused a considerable set back to all crops. As a result of beneficial late rains, however, yields were much better than had been anticipated at the end of September.

Salmon Gums:—Although crops were planted under reasonably satisfactory conditions, the season as a whole was rather unfavourable, particularly during August and September. All wheat crops, however, held out well and with the late rains yields were above estimates.

Wongan Hills:—Although the earlier growth period was good at this Station the dry conditions of August and September affected crops somewhat adversely. A good recovery occurred with the rains in October.

Field Day at the Wongan Hills Research Station, 1947. The farm manager, Mr. D. R. Bateman, explaining the layout of the wheat variety trials.

Details of the rainfall recorded on each of the Research Stations are given in table No. 1.

TABLE I.

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Avondale—														
1947	....	....	23	112	226	372	206	67	45	150	1,066	49	7	1,257
Av. 21 y ..	24	36	101	81	228	335	312	239	99	80	1,294	53	32	1,478
Chapman—														
1947	....	45	62	143	323	338	321	134	156	365	1,637	19	3	1,909
Av. 42 y	24	37	67	75	236	429	393	264	145	90	1,556	38	26	1,827
Merredin—														
1947	10	....	95	119	153	231	190	49	52	192	864	68	....	1,159
Av. 36 y	43	54	96	88	139	196	185	152	80	76	829	42	56	1,208
Salmon Gums—														
1947	4	159	204	168	135	72	80	96	68	206	657	94	7	1,293
Av. 22 y	83	71	144	92	126	150	142	148	92	113	772	89	79	1,331
Wongan Hills—														
1947	46	9	44	91	273	324	224	81	77	212	1,191	41	4	1,426
Av. 22 y	35	46	94	92	195	274	260	200	90	72	1,091	43	41	1,445

Rust Resistance.

Farmers in New South Wales suffered severe losses during the 1947/48 season due to rust epidemics. The variety Eureka which was previously considered to be rust resistant suffered severely due to the fact that it is susceptible to a new biotype of rust race 34, which has developed in the Eastern States during the past few years. Although no wide-spread epidemics of rust have been experienced in this State since 1943 there were localised outbreaks during 1947. These were located on two properties in the Wongoondy district, and as with epidemics in this State (Cass Smith, Millington, 1944) the outbreak of the disease was preceeded by heavy summer rains. An excellent opportunity to study under field conditions the rust reaction of standard and introduced varieties was afforded in a Wheat Variety Trial conducted by Mr. G. L. Throssell, Agricultural Adviser, on one of the affected properties. The Trial included the standard varieties Bungulla and Bencubbin, the New South Wales Department of Agriculture's variety Charter and two cross-breds from the Merredin Research Station, M. 77 and M. 80.

Mr. Throssell's observations are as follows:—

> "The two farms concerned experienced a localised thunderstorm in March when 325 points of rain were recorded. This resulted in an abundant growth of early green feed which was 12in. high in May. The very severe outbreak of rust occurred in September and crops of Bencubbin and Bungulla were almost totally destroyed. Of the two new cross-breds from the Merredin Research Station, M. 80 now registered as Wongoondy proved to be immune and M. 77 highly resistant."

Portion of a Wheat Variety Trial—Merredin Research Station, 1946. Each plot is one-eighth of an acre and is replicated five times in Randomised Blocks.

This substantiates the recommendation of the Department of Agriculture that when nearby paddocks contain self-sown crops heavily infected with stem rust at planting time then an epidemic of that disease during the season is very probable. Losses from rust can be best minimised by having on hand substantial supplies of resistant varieties for planting in such seasons of high rust hazard.

As mentioned previously, in the Eastern States, a strain of rust has appeared which attacks the hitherto resistant variety Eureka and its derivatives. In these States Eureka is no longer regarded as a rust resistant variety.

Fortunately this new biotype of rust race 34 has not as yet been located in this State, but there is little guarantee that it will not eventually be recorded here. In the meantime the Department of Agriculture seeks the co-operation of farmers in the obtaining of rusted wheat plants, and as soon as the disease is observed specimen plants should be forwarded to the Government Plant Pathologist, Department of Agriculture, Perth.

Two new varieties of wheat are being registered by the Department of Agriculture. One of these, Wongoondy (Eureka x Bungulla), tested in Variety Trials as M. 80 derives its rust resistance from Eureka and therefore cannot be regarded as a rust resistant variety except under conditions in Western Australia at present, that is it is susceptible to the biotype or Eureka attacking race of rust. The other variety Dowerin (Sword x Kenya C. 6041) tested in Variety Trials as M. 71 derives its rust resistance from the variety Kenya C. 6041 and is the only variety yet released in Australia with this type of resistance. This variety is resistant to all known races of stem rust in Australia. A further description of these two varieties is given under the heading of "Recommended Varieties."

Kenya C. 6041 is one of the varieties collected from the Kenya colony by the New South Wales Department of Agriculture and the farming industry is deeply indebted to them for their enterprise in collecting varieties in all parts of the world and subjecting them to tests for rust resistance.

Also this Department is very grateful to Drs. Waterhouse and Watson of the Sydney University for their very valuable co-operation and assistance. Prior to the appearance of the biotype of Race 34 of stem rust they made available rust material when necessary to enable the disease to be maintained in the Research Station rust gardens for testing purposes.

However since the new strain appeared and as it would be dangerous to introduce rust material from the Eastern States, they have undertaken the testing of the more promising crossbreds from the Research Stations for resistance to the biotype.

Table No. II which was published in the March Journal, 1941, is here reprinted to illustrate the position of the two new varieties with regard to other resistant varieties.

TABLE II.

Breeder.	Type of Resistance.			
	A. Eureka.	B. Kenya, C6041	C. Kenya, C6042.	Mature D. Plant.
New South Wales Department of Agriculture	Eureka Frisco	... ...	Charter Yalta	Celebration ...
W.A. Department of Agriculture ...	M.78 M.79 Wongoondy M.81	M.70 Dowerin	... ...	... ...
Sydney University	...	...	Gabo Kendee	Hofed Fedwed
Waite Institute	...	...	...	Warigo

Data published by Drs. Waterhouse and Watson form the basis of this table which classifies the types of resistance possessed by the rust resistant varieties now under cultivation in Australia or undergoing advanced trials. For very rust liable areas in Western Australia it would be advisable to have on hand reserves of varieties possessing the B.C. or D. types of resistance rather than the A or Eureka type.

Flour Strength.

One of the primary objectives of the wheat breeding programme in this State is to raise the strength of the West Australian standard wheats to the level that it does not need assistance from or building up by a strong wheat. This strength is referred to as "filler", since after the miller has adjusted the proportions of strong and weak wheats in his blend, he can use an unlimited amount of "filler" wheat without materially altering the strength of the resultant flour. Tests have shown that the popular varieties, Bencubbin and Bungulla, are capable of "filler" strength under suitable soil and climatic conditions and this directs attention to the fact that even though the variety is capable of producing grain of high baking quality this is only possible under favourable soil and climatic conditions. In other words no matter how good may be the variety evolved by the plant breeder, unless the farmer maintains the fertility of his heavier land and builds up the fertility of lighter soil types by use of wider rotations and the inclusion of legumes, such as subterranean clover, peas, lupins, etc., then the variety does not have the opportunity of expressing the true value of its grain quality.

Results have shown that the baking quality of varieties grown on light land can be improved considerably by building up the fertility of the soil with such legumes (Samuel L. W. 1944). Although it is the policy of this Department to release only varieties of improved baking quality in an endeavour to improve the baking strength of the standard wheats part of the responsibility lies with the farmer in his ability to maintain the fertility of his soil.

A comprehensive summary dealing with the various tests for flour strength and a discussion on strength and environment was published in the March, 1947 issue of this Journal.

Variety Trials.

As in previous years rust resistant varieties released in other States were included and five promising cross-bred varieties from the Merredin Research Station, which were tested for the first time in 1946, were again included in these Trials.

As previously stated Variety Trials are a comparison between varieties, the standard variety being the control with which other varieties are compared under similar conditions of soil and climate. As there is a diversity of soil types even in small areas experimental plots are randomised in an endeavour to overcome as many yield differences due to soil type as possible.

Also as it is not possible to obtain accurate data from one set of plots only, each treatment is repeated five times and an average yield taken for the five plots. It is the standard practice on Research Stations in the wheatbelt of this State that each plot be 1 drill width (15 links wide) and 10 chains long, the plots being planted wheel on wheel thus leaving a narrow unplanted buffer between adjacent plots. At harvesting the plots are reduced in length to 833 links giving an area of one-eighth of an acre harvested and the yield per acre computed for each variety.

Results of the Wheat Variety Trials carried out during 1947 are tabulated in Table No. III.

TABLE III.
WHEAT VARIETY TRIALS AT RESEARCH STATIONS.

	Avondale.			Chapman.			Merredin.			Salmon Gums.			Wongan Hills.		
	Yield.	Percentage of control.		Yield.	Percentage of control.		Yield.	Percentage of control.		Yield.	Percentage of control.		Yield.	Percentage of control.	
		1947.	Average*		1947.	Average*		1947.	Average*		1947.	Average*		1947.	Average*
EARLY MAY TRIAL.															
	Bus. lb.	%	%	Bus. lb.	%	%	Bus. lb.	%	%	Bus. lb.	%	%	Bus. lb.	%	%
Bencubbin	27–52	100	100 (4)	18–11	100	100 (4)	13–14	100	100(4)	23–22	100	100 (4)	17–44	100	100 (3)
Eureka	33– 6	119	101 (4)	18–43	103	87 (4)	8–26	64	80 (4)	16– 3	69	79 (4)	15–31	88	88 (3)
Kondut	29–52	107	100 (4)	18– 5	99	94 (4)	9–46	74	73 (4)	18– 6	77	83 (4)	15–23	87	85 (3)
Yalta	22–44	80	....	14– 0	77	86 (2)	5–41	43	....	15–18	65	....	13–39	77	....
Celebration	....	....	....	15–25	85	....	....	....	....	....	....	....	....	....	....
Difference for Significance P = ·05	4–10	15·0	....	1–34	9	....	0–47	6	....	1–55	8	....	1–46	10	....
LATE MAY TRIALS.															
SECTION I.															
Bungulla	21–33	100	100 (4)	7–28	100	100 (4)	10–34	100	100 (4)	19–38	100	100 (4)	14–53	100	100 (4)
Koorda	....	....	86 (2)	7– 9	96	88 (3)	8–18	79	78 (3)	....	....	91 (3)	12–45	82	85 (3)
Frisco	....	....	....	7–49	195	....	10–50	103	....	....	....	....	10–50	70	....
Gabo	31–33	147	....	8–15	110	....	6– 0	57	81 (2)	19–38	100	....	12–13	79	....
Kendee	30–13	141	....	10– 7	135	....	5–34	54	81 (2)	19–28	99	....	12–19	80	....
Charter	23– 6	107	97 (3)	....	....	....	....	....	....	17–14	88	92 (3)	....	....	....
M.71	27– 6	126	....	....	....	....	....	....	....	....	....	....	....	....	....
M.77	....	....	111 (1)	....	....	....	....	....	....	18– 2	92	96 (2)	....	....	....
M.78	22–41	105	....	....	....	....	....	....	....	18–11	93	....	....	....	....
M.80	32–40	152	129 (2)	....	....	....	....	....	....	18–40	95	103 (2)	....	....	....
Difference for Significance P. = ·05	3–35	17·0	....	0–50	11	....	1–20	13	....	1–28	7	....	1–58	13	....
SECTION II.															
Bungulla	....	....	....	11–46	100	100 (4)	9–36	100	100 (4)	....	....	....	14–59	100	100 (4)
Charter	....	....	....	10–51	92	92 (4)	7–44	81	88 (4)	....	....	....	11–20	68	77 (4)
M.70	....	....	....	....	....	....	6–30	68	....	....	....	....	....	....	....
M.71	....	....	....	13–51	118	107 (2)	9–10	96	95 (2)	....	....	....	....	....	....
M.77	....	....	....	17–36	150	128 (2)	10–45	111	108 (2)	....	....	....	11–30	69	88 (2)
M.78	....	....	....	....	....	....	9–54	103	98 (2)	....	....	....	12–29	75	....
M.80	....	....	....	13–31	115	104 (2)	10–18	107	112 (2)	....	....	....	12–50	77	89 (2)
Difference for Significance P. = ·05	....	....	....	1–48	15	....	1–18	14	....	....	....	....	1–20	9	....

*Number of trials indicated in parentheses.

However, due to such uncontrollable factors as soil variability etc. two adjacent plots sown on the one day to the same variety and with identical cultural and fertiliser treatment may not give equal yields. It is possible, however, to calculate in bushels per acre for any correctly designed experiment the allowance which must be made for the uncontrollable factors, and this figure appears in the line "difference for significance P = .05."

If one variety yields 10 bushels and another 15, that is a margin of five bushels, and the difference for significance is three bushels, then the higher yielding one significantly outyielded the other. If the margin had been two instead of five bushels, the difference would not have been significant. It would be assumed that the varieties were equal in yielding ability and that the difference in yield of two bushels per acre was due to soil variability and similar uncontrollable sources of variation.

New Varieties.

Celebration—This variety was to be included in the 1946 Trials but arrived from the Eastern States too late for planting. It was, however, planted in the trials at the Chapman Research Station in 1947. Produced by the New South Wales Department of Agriculture, it is highly resistant to flag smut and stem rust, including the biotype 34 to which Eureka is susceptible. It has a mature plant type of rust resistance, the grain quality is good, being in the premium class.

Frisco (Kenya x Florence x Dundee) x Gular.—Bred by the New South Wales Department of Agriculture, this early mid-season wheat derives its rust resistance from Eureka and is susceptible to the Eureka attacking biotype of rust. It produces grain of good quality and yields from Variety Trials so far have been promising.

Kendee (Kenya x Dundee).—A mid-season maturing wheat bred at Sydney University and having the Kenya C. 6042 type of rust resistance with a resistance to all known races of stem rust in Australia. It has strong straw and the grain produces a medium strong flour under favourable conditions. Yields in Western Australian trials so far have been satisfactory, especially under higher rainfall conditions.

Gabo—This is an early maturing wheat bred at Sydney University which is strongly resistant to all races of stem and leaf rust known to occur in Australia, but is susceptible to flag smut. It has short, strong straw and in the Eastern States has maintained high milling and baking quality when grown under differing climatic conditions. Results in Western Australia so far indicate that it is an early maturing variety for the higher rainfall areas needing good finishing conditions to yield well.

Yalta—The cross, Kenya x Pusa IV x Dundee was made at Glen Innes, New South Wales and the variety named in 1945. This mid-season maturing variety bred by the New South Wales Department of Agriculture, has a rust resistance similar to Kendee, the straw is of medium height, stands well and the baking quality of the grain is in the premium class. It is highly resistant, although not immune, to flag smut. It is, however, susceptible to loose smut and to ensure resistance to this disease, the seed planted in the 1947 trials underwent a treatment known as the Hot Water treatment. This had an adverse effect on the germination of the seed in these trials and for that reason the results obtained are not an accurate indication of the yielding ability of the variety. It does, however, give promise.

Cross Breds.

M. 70—Sword x Kenya C.6041—Early maturing, tall growing variety which is resistant to all known races of rust in Australia. It is similar to Dowerin (M. 71)

M. 77 and 78—Bencubbin x Eureka—These early maturing varieties have given promising yields and are being retained for further trial. M. 77 is apparently segregating for rust resistance as there was a slight infection in the Wongoondy trials. At Merredin M. 77 usually yields flour which approaches premium standard, while M. 78 is even stronger. Both have satisfactory straw strength.

Recommended Varieties.

With regard to maturity standards it is customary in Western Australia to classify wheat varieties into four standard maturity groups relative to the early maturing variety Gluyas Early.

1. Very early maturing, flowering five or more days earlier than Gluyas Early.
2. Early maturing, flowering four days earlier to 3 days later than Gluyas Early.
3. Midseason maturing, flowering four to nine days later than Gluyas Early.
4. Late or late midseason, flowering ten or more days later than Gluyas Early.

The following are short descriptions of the recommended varieties included in the 1947 Variety Trials:—

Midseason.

Bencubbin.—This is the standard midseason variety which is the most extensively grown variety in Western Australia and also in Australia. Straw strength tends to be weak on light land, but is satisfactory for hay. Bencubbin is noted for its high yields under inferior seasonal conditions but has been replaced by Bungulla by many farmers in the lower rainfall areas. It still remains the most prolific midseason variety for the Western Australian wheatbelt. It is resistant to flag smut but very susceptible to rust. Its flour strength is equal to the State f.a.q.

Kondut.—Has yielded well at Avondale over the last two years, but generally returns have been below Bencubbin. It is strong strawed and is recommended for planting on ploughed up clover land, on light land and under high rainfall conditions. Although not rust resistant it gives better yields under epidemic conditions than Bencubbin and Nabawa. It is resistant to flag smut, yields flour which is usually superior in strength to that of the f.a.q. and is strong strawed.

Eureka.—Although this variety yielded well in several trials in 1947, average results over the past four years have been disappointing and it will probably be replaced by a variety such as Dowerin which is resistant to the new race of rust to which Eureka and its derivatives are susceptible. Eureka is a stout strawed, tall growing variety with translucent grain. Under slow ripening conditions the grain frequently mottles. The flour strength of Eureka is well above the f.a.q. of this State.

Early Maturing.

Dowerin.—This variety was selected at the Merredin Research Station from a cross between Sword and Kenya C6041 made in 1937 by E. C. B. Langfield.

It is unique in that it is the only variety released, which derives its rust resistance from Kenya C6041. It is resistant to all known races of stem rust in Australia. An early midseason maturing variety it is tall growing with fine straw and a tendency to weakness under certain conditions. The quality of the grain is in the upper range of the f.a.q. It has yielded well under trial, particularly in the higher rainfall areas. It is resistant to flag smut and powdery mildew.

Wongoondy.—This variety, which was selected at the Merredin Research Station from a cross between Eureka and Bungulla made in 1940, by E. C. B. Langfield is an early maturing variety which, under suitable conditions, produces grain approaching premium quality. Quality tests indicate an average Pelshenke time of 66 minutes, ranging in the average from 46 to 104 minutes and an average strength figure of 9.4 minutes as determined by the farinograph, an instrument used in the laboratory to ascertain baking quality, with a range of 6.3 to 14.4 according to soil and climatic conditions. It is a medium tall growing variety with a straw of excellent standing ability with a white, tapering, tip awned ear, which holds its grain well. It is highly resistant to race 34 stem rust, but not to the biotype of this rust race. This variety gives excellent promise and is favoured for its straw strength, earliness, prolificacy and its satisfactory grain quality. Yield data from five Research Stations and two farmers' trials indicates its good yielding capacity over a wide range of soil and climatic conditions, as compared with varieties which it is expected to replace.

Very Early Maturing.

Bungulla.—The standard early maturing variety which is a selection from Bencubbin. Like Bencubbin is notable for its high yields under low rainfall conditions. Because of its early maturity it usually suffers very little rust damage, but it is not resistant to rust. It is resistant to flag smut. The increased popularity of this variety over the past five years is an indication of its value in the Western Australian wheatbelt, especially in the lower rainfall areas where it has produced consistently under very unfavourable climatic conditions. It is used extensively for planting on ploughed up pasture land and was sown to 21.9 per cent. of the 1946 acreage sown to wheat for all purposes. Its main disadvantage is that it tends to be weak strawed, especially on light land and tends to lodge if sown before the third or fourth weeks of May.

Charter.—Released in 1944 by the New South Wales Department of Agriculture, and bred by Dr. S. L. Macindoe from a cross made at the Glen Innes Experimental Farm in 1931 between a selection of Kenya C6040, resembling C6042 in rust reaction, and Gular. Resistant to all Australian races of stem rust and to flag smut. The straw is tall and has a tendency to lodge.

Koorda.—A relatively recent release by the Western Australian Department of Agriculture, Koorda has yielded well on the lighter soils where its strong straw is of great value. Koorda is practically immune to flag smut and tends to be rust resistant in all but the heaviest epidemics. Flour strength of Koorda is about the same as that of the f.a.q. standard. It has gained popularity in this State during the past few years.

Farmers' Field Trials.

In addition to Wheat Variety Trials carried out on Research Stations various trials are also conducted on farmers' properties. The object of these Farmers' Field Trials is to test new varieties against the standard varieties under field conditions and thus to substantiate results obtained on the Research Stations. Results of the trials carried out in 1947 are summarised in Table No. IV.

TABLE IV.

1947 FARMERS' FIELD TRIALS—WHEAT VARIETY TRIALS.

Variety.	Yield.	Percentage of Control.	Average Percentage.*
	K. WILLIAMS, Northampton.		
	Early Maturity Trial.		
	Bus. lbs.		
Bencubbin	12 0	100	100
Charter	13 6	109	131 (2)
Bungulla	13 50	115	121 (2)
M77	14 48	129	130
Bencubbin	11 28	100	100
Wongoondy	11 46	103	118
	Mid-Late Maturity Trial.		
Bencubbin	13 38	100	100
Eureka	14 50	109	131
Kondut	12 32	92	109
	CARMODY & SONS, East Narrogin.		
	Early Maturity Trial.		
Charter	14 47	84·5	...
Bungulla	16 18	100	...
Wongoondy	16 9	99	...
	Mid-Late Maturity Trial.		
Bencubbin	13 22	100	...
Eureka	14 11	106	...
Kondut	15 13	112	...
	E. A. METCALF, Wyalkatchem.		
	Early Maturity Trial.		
Bungulla	23 33	100	...
Dowerin	24 21	103	...
Wongoondy	25 56	110	...

*Number of trials indicated in parenthesis.

ACKNOWLEDGMENTS.

This opportunity is taken of expressing thanks to the staff of the Research Stations for their assistance in conducting the above trials and also to the farmers whose co-operation made the Farmers' Field Trials a success.

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FERTILISERS—ADDITIONAL REGISTRATIONS.

The following fertilisers have been registered at the Department of Agriculture under the Fertiliser Act, 1928, for the year commencing 1st November, 1947:—

Name of Fertiliser.	Reg. No.	Brand.	By whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works or on Rail Perth.
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust	Water Sol.	Citrate Sol.	Acid Sol.	Total.	Sulphate.	Muriate.	
A.—MINERAL.														
6. MISCELLANEOUS														
Seedling Manure	71	Dawn	Dawn Nurseries	5·3	....	....	....	8·75	1·25 Acid Cit. Sol.	1·0 Cit. Acid Insol.	11·0	4·4	....	
Concentrated Garden Fertiliser	72	Anderson's Excellenta	Anderson & Co.	....	4·1	....	....	9·3	1·4	0·8	11·5	4·0	....	
B.—ORGANIC.														
(*a*) Blood and Bone	73	Pannifex Fertiliser "G"	Burridge-Warren, Ltd.....	....	....	6·25	....	....	7·25	Cit. Insol. 6·25	13·5	....	....	

ERRATA.

Vol. XXIV. No. 4.—December, 1947.

Page 273.—Line 3 for "5 lbs. of powdered copper" *substitute* "5 ozs. of powdered copper."

Page 285—GRAPH—

Reverse legend so that "Butterfat production, 1946/47" appears *opposite* dotted line.

Page 361—FERTILISERS—

Last column, line 4—*For* "22.10.0 P" *substitute* "22.10.0 C.I.F. & E., Fremantle."

Last column, line 6—*For* "1.17.4 P" *substitute* "1.17.4 per cwt."

Last column, lines 7 and 8—*For* "18.0.0 W" *substitute* "18.10.0 W."

Column 6, line 8—*Delete* "30.00" and place *centrally* between columns 5 and 6.

Last line—*Delete* "manganese."

Page 362.—Column 14, above "5.75" *insert* "Manganese."

Column 9, line 13—*delete* "30.00" and *insert* "30.00" in column 13.

Page 363.—Last column line 9—for "13.3.4 W" *substitute* "13.13.4 W."

Column 6 line 11—*delete* "4.1" and *place centrally* between columns 5 and 6.

Column 13 line 11—*delete* "Potash" and "Potash Sulphate."

Column 5 line 15—*delete* "6.00" and *insert* "6.00" in column 7.

Column 5 line 16—*delete* "5.5" and *insert* "5.5" in column 7.

Column 5 line 17—*delete* "5.0" and *insert* "5.0" in column 7.

Column 7 line 21—*insert* "5.25."

Column 7 line 22—*insert* "6.0."

Column 5 line 25—*delete* "3.43" and *insert* "3.43" in column 8.

Columns 5 and 6—line 27—*delete* "2.00" and *insert* "2.00" in column 6.

Column 4 line 28—*for* "Kog Manufacturing Co." *substitute* "Kag Manufacturing Co."

Columns 5 and 6 last line—*delete* "5.00" and *insert* "5.00" in column 7.

By Authority: WILLIAM H. WYATT, Government Printer, Perth.

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